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EDITORIAL ANNOUNCEMENTS

THE BRITISH AND EASTERN CONTINENTS edition of the Railroad Gazette is published each Friday at Queen Anne's Chambers, Westminster, London. It consists of most of the reading pages and all of the advertisement pages of the Railroad Gazette, together with additional British and foreign matter, and is issued under the name Transport and Railroad Gazette.

CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially either for money or in consideration of advertising patronage.*

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The Supreme Court of the United States has sustained the Lake Shore & Michigan Southern in its refusal to furnish the Interstate Commerce Commission with ton-mileage statistics of grain, coal, hay and other specified commodities, but on grounds so technical (if we may judge by the published abstract) that no layman can get at the real reason. There appears to be no penalty prescribed for refusal to furnish information to the Commission, as required by Section 20 of the Act, and the Court holds, apparently, that the Commission, to enforce its demand, must secure new legislation. A mandamus or injunction is denied, because Congress authorizes that kind of remedy only for certain well defined purposes, and this is not one of them. On general principles, the Commission ought to have pretty wide discretion and extensive power in this direction; and yet nothing is more common than the unnecessary and wasteful gathering of statistics, not only in Government offices, but in railroad offices, as well. Any kind of statistical information which the principal railroads keep regularly for their own benefit ought, if it is instructive as regards questions arising on other railroads, or as regards railroad economy as a general question, to be given to the Government statistician. To require even this much by law might possibly work hardship here and there, but on the whole it would probably be as reasonable a rule as could be agreed upon. How many companies keep the figures that Statistician Adams calls for we do not know; nor whether those which do keep them find them worth a tenth of what they cost. If the Lake Shore should accuse Professor Adams of attempting to gather a lot of averages which will afford no useful information to the public when gathered, we should shrink from the task of controverting the accusation.

THE BALANCED COMPOUND LOCOMOTIVE

The balanced compound has for the last ten years been winning a prominent place in the railroad service in France. Its theoretical advantages have been readily recognized by progressive railroad men in America, but it is only recently that a design has been presented of sufficient simplicity to secure a trial. In the last two years, however, one firm of American locomotive builders has put into service 75, and has on its books orders for 73 more balanced compound locomotives. These figures show that the American designers have at last succeeded in producing a design which appeals to the operating department of the railroads and enables them to secure in practice undoubted advantages of the high efficiency and accurate balancing which are given by the four-cylinder compound locomotive with cranks set quartering.

The results obtained both on the testing plant and in actual service have confirmed the judgment of those who have introduced this type of locomotive and give promise of its being an important factor in American railroading in the near future. On the Pennsylvania testing plant at St. Louis a balanced compound made a continuous run of three hours at 60 miles an hour with a consumption of less than 20 lbs. of dry steam per horse-power hour, and on the Chicago, Burlington & Quincy tests carried out by the Aurora laboratory showed that the balanced compound could, under service conditions, be operated with a consumption of 22.86 lbs. of dry steam per horse-power hour. These figures are at least 25 per cent. better than can be obtained with the single expansion locomotive. Other compound locomotives have shown a similar efficiency, but the figures quoted above were obtained on locomotives which are universally popular with the men running them and with those to whom their maintenance is intrusted. This question of popularity may appear at first sight of secondary importance, but it speaks eloquently for the simplicity of design and the ease of operation, which are essential if the cost of maintenance is to be kept down to a proper comparison with that of the single expansion locomotive, so as to enable the locomotive to prove successfully economical in practical service. It is, of course, not sufficient for a locomotive to show a low steam consumption. To achieve success the low steam consumption must be combined with such simplicity as to avoid difficulty in handling and to allow the cost of maintenance to be kept low.

The economy of steam consumption which is obtainable by the use of compound cylinders gives this engine a double advantage over the single expansion engine. More work can be done with the same amount of coal and water and with a lighter locomotive. This last point is of considerable importance when it is a question of high speed service. At 60 miles an hour about four horse-power is required to overcome the resistance and maintain the speed of each ton weight of locomotive and tender, and with increasing speed the amount of power required to overcome the resistance increases very rapidly. It is consequently obvious that for high-speed service the logical method of increasing the hauling capacity of the locomotive is, not merely to increase the heating surface and thus increase at the same time the weight and resistance, but to increase the efficiency with which the cylinders work. This has the same effect as increasing the steaming capacity by increasing the heating surface, and the increase in power thus obtained is all clear again, as there is no increase of weight to increase the resistance.

The balanced compound locomotive which is finding such rapid favor in America is designed to give all of the advantages to be obtained from compounding without introducing any of the drawbacks which have hitherto been encountered, and at the same time to give a sufficient balance of the working parts among themselves to make the locomotive extremely easy on the track. By arranging the engine so that the corresponding high and low-pressure pistons are at 180 deg. from each other, the inertia forces of these parts counteract each other to such an extent as to render it unnecessary to introduce any excess counterbalance for the reciprocating parts. The balance thus obtained for the reciprocating parts is so much better than that of the single expansion engine that the nosing and fore-and-aft jerk-

ing are considerably reduced. At the same time the rotating parts can be counterbalanced so that there is practically no variation in the pressure of the locomotive on the rail when the locomotive is running. This stands in strong contrast to the balancing of a two-crank engine, where the hammer-blow from the excess counterbalance introduced to take care of the reciprocating parts may easily amount to 12,000 lbs. per wheel, or 45 per cent. of the static wheel load. The forces thus introduced stress severely the track or any superstructure which has to carry the locomotive. By balancing the locomotive by the use of four cranks and thus avoiding the hammer-blow effect, it is practicable to carry safely, on the same superstructure, a heavier locomotive. That this claim is not merely academic, is shown by some recent tests made on a girder bridge in the vicinity of Chicago. The deflections of the bridge were accurately measured while single expansion and balanced compound locomotives were run over it at high speeds. The single expansion engine with a maximum wheel load of about 44,750 lbs. gave, at speeds of from 70 to 80 miles an hour, deflections of from 0.12 to 0.15 in. The balanced compound, with a maximum wheel load of about 51,400 lbs., gave at the same speeds, deflections of from 0.09 to 0.12 in. Although the wheel load was nearly 15 per cent. heavier, the balanced engine showed 25 per cent. less effect on the bridge. The relief which this gives to the roadway should be much appreciated by the engineering department.

The position of the cranks in the four-cylinder compound, besides giving a balance of the locomotive in regard to the track, enables the internal forces of the engine to be made largely self-balanced. The high and low-pressure pistons on each side are working in opposite directions and consequently their thrusts oppose and approximately balance each other. The amount of balance thus obtained is sufficient to enable a comparatively light front frame rail construction to be used without fear of breaking.

The combination of advantages outlined above enables the balanced compound locomotive to make strong claims for adoption, and the rapid acceptance of this type of locomotive by American railroads shows that these claims are meeting with due consideration.

PRESIDENT HADLEY ON RATE REGULATION.

President Hadley's paper on federal rate regulation, in the *Boston Transcript*, carries much more weight than previous literature on the subject, because it is written from an unbiased standpoint, intended neither as a brief for the railroads nor for the advocates of federal control of railroad rates. Dr. Hadley points out the confusion which exists in combining general criticisms of railroad conditions with arguments that proposed changes in the federal law will improve things, and shows that many a critic of American railroads bases his advocacy of a particular bill on the public dissatisfaction with certain general methods of railroad management which the proposed legislation would not affect in the least. On the other hand, the railroad men are so impressed with the mistakes in the demands of the reformers that they do not always appreciate the real force by which those demands are backed. The grounds of public complaint are mentioned as being, primarily, a widespread distrust of monopoly, which is directed at the railroads because of their close and extensive combination; the increase in railroad net earnings during the past few years without a corresponding improvement in the service, and arbitrary discrimination in rate making or in the service rendered to small shippers at times of car shortage.

Taking the stand for the railroads, Dr. Hadley says that they admit the fact of monopoly, but hold it to be an inevitable tendency of the age rather than a thing peculiar to the railroad business, and that a part of the monopoly which now exists is traceable to ill-judged acts of legislation. Moreover, they deny that the existence of such monopoly is responsible for abuses by which the public suffers. They claim that it is proper that high profits should be earned in good times, inasmuch as low profits are earned in bad times, and they also claim that the increases in rates have been very slight, viewed as an average, while the prices of goods and of labor have increased much faster, so that the purchasing power of the dollar they receive in payment for transportation is less than it was formerly. In regard to the discrimination resulting from an insufficient supply of equipment, they claim that they must simply view the situation as conservative managers and must not overstock themselves.

In reviewing these respective claims, Dr. Hadley upholds the railroads on the question of monopoly, saying that the tendency for creating artificial monopolies in the railroad business, as distinct from the inevitable monopoly which is due to the need of concentrated service, has not been so great as in many other lines of industry during the last decade: "we need have no sympathy with a man who, trying to organize a combination of producers which shall be outside of the control of the law, would subject the combination of railroads which transport his products to market to some special forms of control to which he himself is exempt." He also upholds the present general rate schedule, but criticises the lack of equipment, which at times results in a severe discrimination against the small shipper, and says that what railroad managers often fail to see is that those in charge of a monopoly have wider responsibilities than the managers of a business conducted under free competition.

The change in tone which is occurring in a good many parts of American railroad service to-day as compared with that of twenty years ago is pointed out. The labor unions have tended to reduce the interest in promotion and progress among the men they include, while higher in the service another group of employees tacitly accepts the domination of banking interests in railroad policy, and thereby gives up much of the personal ambition which was characteristic at an earlier period and which had the good result, along with some bad results, of creating a very progressive system of railroads in this country. Dr. Hadley says that there are still splendidly strong men as presidents and general managers of the great railroad systems, but these men would be the very ones to confirm the statement that ability of their type is becoming scarce, while half a dozen causes have combined to kill, among the rank and file of railroad operators, the former ambition for successful and progressive conduct in the actual work of transportation.

With regard to measures of public control, he takes a middle position between the strong advocates on each side of the question, holding that there is enough evil to make it worth while to study carefully any measure that promises relief and improvement, while there is enough good in the present situation to make it wise to reject unhesitatingly the arguments of those who wish to have Congress enact laws without such scrutiny. That Congress is powerful enough to confer railroad rate making on a federal body, he admits without argument, but that no great stress need be laid on the statement that such an ocurrence would be disastrous to the railroads. He says that all the power that might be assumed by the Interstate Commerce Commission under any conceivable circumstances would not be likely to do the railroads of the country one-tenth of the financial harm which resulted from a measure of general legislation like the pooling clause of 1887. But while Congress could undoubtedly increase the powers of the Interstate Commerce Commission if it wanted to, and that without any real financial damage to the railroads, it is improbable that such action would result in much good to the public. The power to make rates for traffic of the United States is too vast a thing to be handled by the machinery of the commission, even if the power and expanse of that machinery were considerably increased. The initiation of a successful rate policy must come from the owner, not from somebody else who tries to control the action of the owner. Dr. Hadley says, "I do not know a single instance of really successful rate making by a government which attempted to control roads that somebody else operated."

The means of relief suggested by Dr. Hadley is the appointment of a special railroad court, not to do over again the work of the commission on questions submitted to it, but to act on information supplied to it by the commission, which would then serve as a kind of expert special counsel. He points out that a semi-judicial commission to regulate rates has not worked well in England, where the system was tried pretty thoroughly, nor has the past history of the Interstate Commerce Commission indicated that it is likely to work well in this country. Given a body of men who are neither judges nor technical experts, but who assume to perform the functions which belong both to judges and to technical experts, and you are practically certain to find a great many of their decisions reversed. Dr. Hadley is not prepared to say just how much a special court could accomplish, realizing that, while it would doubtless have authority to declare certain rates unreasonable, it might get into trouble when it tried to indicate how much they would have to be reduced in order to be reasonable. He is evidently inclined to think that a system of regulation by negative rules which will be upheld and obeyed is rather to be sought as a basis of practical reform than one based on positive rules, whose authority is uncertain, and he says further that the history of equity jurisdiction in its various branches shows that when the higher courts of any country have really made up their minds to have certain things done, they get

them done, but that the attempt to secure the same result faster by means of short cuts creates so much confusion and uncertainty as to delay the very consummation which it has been intended to hasten. He holds that the Interstate Commerce Commission represents just such a short cut. He points out, in closing, that in 1870 the popular voice regarded the Massacuhsetts Railroad Commission as ridiculous and the commissions of the states of the Middle West as efficient bodies whose work promised a solution of the evils under which the country suffered, yet before the year 1880, the work of these "efficient" commissions had been swept away completely, and the real reforms which were being made went back to the conservative men in Massachusetts for their starting point.

With the moderate point of view taken by Dr. Hadley we are heartily in accord, both in his belief that there are real wrongs to be righted and in his conviction that the radical methods which have been so frequently suggested of late would not only be harmful, but would not accomplish even the object that their promoters sought. The idea of regulation by a general series of "negative" rules seems clearly right. Whether an Interstate Commerce Court would be able to do anything positive, in view of the fact that making rates for the future in any form whatever is a legislative and not a judicial act, is highly doubtful. Dr. Hadley fails to point out specifically one of the real evils that is most serious at the present time, and that is the law's delay, which operates every time in favor of the railroad corporation, and is undoubtedly a direct source, conscious or unconscious, of a good deal of the public hostility to the railroads. If such a court as Dr. Hadley suggests could expedite the simple processes of law by which matters under dispute could be adjudicated, it is certain that good would be done. Just how this would work out in practice is hard to foresee, but the keynote of moderation sounded is surely the right one in the existing situation.

Mr. Mellen's Open-Air Lobby.

On March 30, President Mellen, of the New Haven road, made a long address before the railroad committee of the Connecticut House of Representatives. He said that the desire had been frequently expressed by many citizens of the state that the railroad company should appear before the Legislature with clean hands, represented by its responsible officials, and prepared to offer the fullest and freest explanation of what it wanted and the reasons why. Mr. Mellen pointed out the interdependence of the railroad interest with the common interest in the state and asked frankly that the charter of what is known as the Consolidated Railway Company, constituting the organization of the New Haven road's electric lines, be broadened under general laws and given extended powers. He said that, had the charter of the New York, New Haven & Hartford permitted, the Consolidated Railway Company would probably never have been heard of, and that, when the Consolidated had completed its work in the fullness of time, he had no doubt it would become in truth a part of the larger company, which now owns its entire capital stock. Many of its lines were originally built with limited capital, resulting in poor alinement and poor grades, so that the public has, in consequence, had indifferent service. He desired, by charter amendment, the power to remedy these defects, and he sought the right of eminent domain, as enjoyed by the steam railroads, in order that the necessary changes might be made quickly and the company might not be held up by ambitious land owners. There is now no general state law under which electric lines can be built in Connecticut, so that it is necessary at each session of the Legislature to secure authority for what it is proposed to do. Mr. Mellen respectfully submitted that he could do more for the public on the lines proposed than could any other party, and asked time to make his own decision at a number of points before others were given franchises in opposition. He also asked the right to acquire and develop water powers under general law; the extension of the powers heretofore granted the separate companies now owned by the Consolidated to build certain branches specified in their charters, and the right to eliminate the interest of dissenting stockholders upon liberal terms in order to protect the company from blackmail in the conduct of its business.

Proceeding then to the consideration of other measures desired besides those in relation to the charter of the Consolidated Railway Company, Mr. Mellen spoke about his experience while on the Northern Pacific in starting an agitation in favor of per diem and of the excellent results to the Northern Pacific from the workings of that rule. But he said that when he came to New England, he found per diem was a very serious tax on the eastern roads. He asked the Legislature to change the present Connecticut demurrage law, which places a heavy burden on the roads in the state. It will be recalled that this law provides that the railroads must allow consignees four days in which to get their cars unloaded, thereby subjecting the railroads to a heavy per diem penalty which they are unable to avoid.

Mr. Mellen spoke frankly and freely about the survey recently made across the state by New York Central interests and asked the Legislature to bear in mind that the surveyed line touched no commercial centers, served no particular territory susceptible to development, and was, in short, purely a threat. He complained that the laws now keep trolley extensions under strict bounds, but leave a foreign steam railroad corporation quite free to make incursions into competitive territory where no result could ensue other than a traffic war.

It is a remarkable sight to see the president of a railroad which has been well known for the efficiency of its lobby, go straight to the Legislature with his troubles and express them with absolute candor. This talk of Mr. Mellen's looks like the opening chapter of an interesting experiment in the maintenance of working relations between the railroad and the commonwealth. It is pretty important that the law makers of the commonwealth should get the railroad's point of view, for the point of view of the opposition will reach them directly enough. But on matters like those of incursion by a rival line it has been customary to use methods of air-tight secrecy, and when privileges of a reasonable but debatable type were wanted, there have been grounds to suspect, in a good many states besides Connecticut, that the customary way to secure the privileges worked on quite different lines from those now chosen by Mr. Mellen. The interesting question comes up for proof in the results of the present experiment, whether a frank and responsible statement of the needs of a great corporation will get enough public opinion on its side to constitute an argument with a state legislature. If it does, Mr. Mellen will have demonstrated that honesty is the best policy, in a place where it has always been thought to be about the worst policy.

The Government Accident Bulletin printed in this issue gives interesting notes on the causes of the principal accidents which occurred in the quarter (ending December 31 last), but contains little information beyond that which was given in the *Railroad Gazette* accounts of the same accidents. Referring to the numbers in the bulletin table of class A accidents, the collisions at West Philadelphia and at Maud, Ill., (Nos. 19 and 23) are explained more clearly than in the earlier accounts; derailment No. 3 is explained authoritatively, but the essential cause was known before. Some instructive details are given concerning a number of accidents which were reported in the *Railroad Gazette* very briefly or not at all. Collision No. 1 occurred from a complication rather unusual, one of the contributing causes being the dazzling rays of an electric headlight. Collision No. 2 is, we think, unprecedented in the government records—a collision reported as "unavoidable." Most readers will probably agree with the flagman in this case, who decided that under the circumstances it was useless for him to try to stop a train in a smoke-filled tunnel. Collision No. 21 illustrates how torpedoes and fusees and all other safeguards may fail a flagman at a critical time if he has not fully prepared himself for all emergencies. Collision No. 22 resulted in action by the road looking to the prevention of collisions from a similar cause in future—the rewriting of an order by the receiving operator. In view of the infrequency of cases where new and additional copies of orders are needed it may well be questioned whether the proposed remedy—to require the operator to repeat to the despatcher a second time—will prove adequate. Indeed, a considerable percentage of errors in orders are due to careless repeating, or careless reading of repetitions; and this repeated repeating is just the kind of work that will be liable to be slighted, if anything is slighted.

NEW PUBLICATIONS.

Cement and Concrete. By Louis Carlton Sabin, B.S., C.E., Assistant Engineer, Engineer Department, U. S. Army; member of the American Society of Civil Engineers. New York: McGraw Publishing Company, 1905. Octavo, cloth, X + 507 pages. $5. This volume aims to take a middle course between a mere statement of facts and a too detailed and extended discussion of the subject. It begins with the history, methods of manufacture, constituents and classification of hydraulic cements. This is followed by a discussion of the desirable properties of cements and the methods of testing. The effect of the degree of burning, age of the cement, and fineness on the time of setting and on the tensile strength of both neat cement and cement mortar is illustrated by a number of tables of results of tests. Many tests were also made to determine the effects of the temperature and per cent. of water and amount of gaging in making briquets. In addition to the usual tests, experiments were made on the adhesion of neat cement and cement mortars to the different building materials. Experiments were also made with different kinds of calcareous, siliceous, and slag sands to determine the fineness, voids, methods of mixing and cost of mortars of different proportions. Then the corresponding experiments were made on concrete, and a description of a number of concrete mixers is given. The cost is given per cubic yard, together with the cost of each item, for the concrete used in many

of the large Government works. Tests were made of the adhesion of differently proportioned cement mortars to steel bars and on the modulus of elasticity of cement mortar and concrete; and on the preservation of steel embedded in concrete. This is followed by a discussion of concrete steel construction and of reinforced beams. Theoretical rules are given governing the size and placing of the steel bars in the latter. In connection with this there is an error in the example on page 394. The total load per foot width of beam is 12,500 lbs. and not 125,000 as stated. Some concrete members are stated as abstract members, as, for example, the modulus of elasticity of steel is stated as 28,000,000 instead of 28,000,000 lbs. per square inch. The latter part of the book contains a short description of almost every use to which concrete is now applied, and references are given from which the data for all the large concrete structures may be found. The value of the book lies in the tabulated results of many thousands of specimens tested in the ordinary course of work, supplemented by many additional tests made to investigate certain doubtful points. These results are given in 161 tables which are valuable for reference and comparison.

TRADE CATALOGUES.

Magnesia Coverings for Boilers, Pipes, Etc.—The Philip Carey Mfg. Co., Cincinnati, Ohio, sends four pamphlets, all of which pertain to magnesia coverings. The pamphlet bearing the title "Carey's Special" is devoted entirely to describing Carey's 85 per cent. magnesia locomotive loggings, and contains a number of half-tone illustrations of locomotives on which it is used. Another pamphlet bears the title "The Carey Roof." This gives a detailed description of Carey's magnesia flexible cement roofing and also gives directions for applying the same. "Carey's Coverings" is the title of the third pamphlet and it contains full detailed descriptions and illustrations of the various forms of pipe coverings made by the above company. The fourth pamphlet bears the title "Practical Experience," and it contains a number of highly commendable testimonial letters from parties who have had experience with the Carey coverings.

A Modern Industrial Plant.—The development and evolution of a business as a result of specialization is well evidenced by Dodge & Day's new Bulletin No. 175, "A Modern Industrial Plant." Dodge & Day have made a study of economics as applied to manufacturing establishments, and the engineering work of their mechanical, electrical and architectural departments assures harmony of buildings and equipment. The bulletin contains a graphical chart of their organization and illustrations of their methods. It indicates that they are now prepared to layout, construct, equip and systemize new plants, as well as modernize old ones. Their methods are applicable to all lines of manufacture, so that the bulletin is of almost universal interest. The bulletin is for free distribution.

Electric Bells.—The Rolfe Electric Company, of Rochester, N. Y., issues a pamphlet describing the Schwarze "universal" electric bells made by that company, which are claimed to work with 60 to 80 per cent. less current than is required to ring ordinary bells. Two gongs, fixed side by side, are rung by a hammer hanging like a pendulum between two vertical electro magnets (above the bells) which alternately move the hammer. The magnets are enclosed in a dust-proof and weather-proof case. The pamphlet also describes fuse boxes made by the company, and has a supplement containing electrical definitions, tables of electrical measurements, etc., and other electrical information.

Machinery.—General machinery catalogue No. 7, of Williams, White & Co., Moline, Ill., is a 7 x 9¼ volume containing 171 pages. It fully describes and illustrates the large line of forging, punching, shearing and hydraulic machinery made by this concern, the illustrations being large half-tone engravings and the descriptions in good clear type. An important specialty of the company is "bull-dozers," which are given the leading place in the book, occupying the first 23 pages. The catalogue is a good piece of work and contains much interesting matter.

Supplies and Car Specialties.—This is the title of a booklet which is being distributed by the J. G. Brill Company, Philadelphia, Pa. It is handsomely illustrated and contains descriptions of the following supplies: Springs, track scrapers, sand boxes, gongs, signal bells, angle-iron bumpers, radial drawbars, ratchet brake handles, folding gates, round-corner seat-end panels, portable vestibules, vestibule door controllers, brake-shoes, curtain-roller spring-adjuster, "Hercules" car jack, motor lift.

Steel Ties.—The Truss Steel Tie Co., Pittsburg, Pa., owner of the Case-Epps system of steel tie construction for railroads, issues a catalogue describing the system, which has recently been patented. The Case-Epps tie is formed of a rolled I-beam section and is fastened to the rail with an ingenious form of clip. The ties are not laid parallel to each other but are staggered at an angle to the rail, bringing the ends of two adjacent ties together.

Steam Engines.—A booklet descriptive of the Richards Corliss steam engine is being distributed by the Corliss Engine Works, Philadelphia, Pa. A number of illustrations of the engine, as well as a full detailed description of the same, are given. The book closes with a partial list of the users of the Richards engine and testimonial letters in regard to the same.

Roofing.—The March issue of the *Exchange*, published by the Standard Paint Co., New York, in the interests of Ruberoid roofing, contains a number of illustrations of buildings covered with this article, and letters from those who have used it. It also has a number of short articles on subjects of interest to consumers of roofing and paint.

CONTRIBUTIONS

The Svea Caloric Engine.

Worcester, Mass., April 6, 1905.

To the Editor of the Railroad Gazette:

Permit me to refer to your account of the external-combustion engine described on page 316 of your issue for March 31st, the Svea caloric engine. It may be of interest to its promoters and others to have their attention called to the following considerations: Assuming an atmospheric temperature of 59 deg. Fahr. and that the motor-cylinder would receive the air at a temperature of 600 deg. Fahr., which is quite as high as safe practice permits in steam-engine cylinders, the maximum theoretical efficiency possible is 31 per cent. and the maximum theoretical power developed would be 1.45 h.p. Since good engineering practice usually develops only some 60 per cent. of the theoretical efficiency on the piston, it is safe to say that this engine will not go beyond 69 per cent. This means 21 per cent. indicated efficiency and 1.00 h.p. on the piston, or not enough to cover the probable friction of the machine. This is the old story with this type of engine, which has been repeated many times since 1825; fine theoretical efficiency, but no power. It will continue to be repeated until designers in this field learn to compete with the internal-combustion engine upon terms of equality; that is to say, with working-pressures equal to those of their rivals.

SIDNEY A. REEVE.

Chicago's Elevated Roads.

Chicago, April 2, 1905.

To the Editor of the Railroad Gazette:

In your issue of March 31 you printed an abstract of my recent report upon increasing the capacity of the Union Elevated Railroad of Chicago, and in an editorial you questioned some of the recommendations made, and suggested certain other methods which to you seemed better. Your editorial must have been written without a clear knowledge of the physical conditions which complicate this problem, and the state of mind of the citizens of Chicago regarding the construction of additional elevated structures within the present loop district.

You concur with me in recommending that the platforms of the loop stations be extended, but disagree in the method of using them. You contend that instead of operating the trains of the different railroads separately, in five or six-car trains, they should be combined, by the adoption of the multiple-unit system, into single trains of twice the length of the present trains, and these single long trains should be operated around the loop; your argument being that by this method the trains would be put around the loop quicker than when operated as I suggest. It is unfortunate that you do not carry the description of your system further and outline plans for coupling up the various trains of the different roads into these long trains, and stating the length of time which in your judgment would be consumed by thus stopping all the trains outside the loop to couple up, and then get under way so as to go around the loop as a single train; and the congestion that will result when these trains must be stopped on the loop to uncouple before leaving it in order that each train may be diverted to its proper road. The Metropolitan road alone operates trains of from two to six cars each from four different roads on to this loop, and if these trains were coupled together in order to run around the loop as you suggest, they would have to be again uncoupled, separated and sent out over the different divisions after leaving the loop, while the trains of the other roads would have to be combined and separated after entering the loop. I believe it is evident that the congestion to traffic on all main lines and on the loop, while these operations were being performed, would be prohibitive, and would also consume much more time than would be gained by your method of combined train operation while passing around the loop.

The advantages of the use of the multiple unit system on the trains of all the roads were fully realized by me and on page 12 the report reads: "When the advantages of this improvement (the use of power mechanism for operating the present junction point switches and signals) and of the use of the multiple-unit system on the cars are utilized, I know of no way that the capacity of the loop, as now built, can be increased under the present method of

individual ownership operation, except by extending the platforms, and when this is done, relief to the present loop district must come from the development and operation of stub-end or other terminals for each road, unless unification or some method of joint operation can be effected whereby through routing can be adopted as hereinafter described."

The use of the multiple unit system by all of the roads would permit the motormen of the various roads to handle their trains at practically the same average speed, and allow them to run up to the extended platforms with a greater degree of certainty than they can now do, as has recently been proven since the adoption of the multiple unit system by the Metropolitan road, which road operates over the same tracks of the loop (the inside track) as the South Side Elevated, the latter having used the multiple unit system since it was first electrified. It is found that the trains on this track can get around the loop in nearly three minutes less time than trains on the outer loop, which are still using the single motor-car system. It is for this reason that I suggested the adoption of the multiple unit system on all roads, and I am certain that my figure which you question, of 25 per cent. increase, due to the extension of the platforms is conservative.

You also say, "There is another way out of the difficulty not mentioned in the report, which has the merit of being less expensive to carry out than the elevated crossing scheme with through routing, which would relieve the congestion on the loop to an even greater degree. Like Mr. Arnold's plan it would involve the partial through routing of trains by the consolidation of all the roads, and in addition would require a new structure to be built on Quincy street between Fifth avenue and State street." In the first place, it is my opinion that the citizens of Chicago would not permit the construction of this or any other additional elevated structure within the present loop district, even if it should be proven to be better as a railroad proposition; and in the second place, this road if constructed on Quincy street, as you suggest, would pass directly through the center of the new United States government building, which has recently been built at an expense of about five million dollars: two conditions which I think would make the plan prohibitive. Furthermore, this plan would necessitate an additional junction point at Quincy street and Fifth avenue, which would tend to further congest the loop. It would also provide rather a torturous passage for the trains, as it would necessitate two right-angled curves on Congress street, in order to connect with the present stub-terminal of the South Side road. In fact, it is my judgment that an examination of the physical conditions surrounding the construction of this proposed extension would convince you of its impracticability. You also say that "a modification even simpler would be to run the West Side trains up Fifth avenue and out on the main line and through route the South Side and Northwestern trains around the east and north sides of the present loop, thus doing entirely away with the elevated track on Van Buren street. By a suitable transfer-station at Lake street and Fifth avenue the accommodations offered would be almost as good as with the present system, when the trains of all four roads pass around the entire loop."

Since you do not define what the main line is I am unable to understand your meaning, but I am very certain that you would have great difficulty in convincing the managers of the present elevated roads in Chicago that it is practicable to handle at one transfer point, the great number of passengers who now have the choice of transferring at most of the eleven stations on the loop. Furthermore, it is impracticable to build a station at Lake street and Fifth avenue owing to lack of room between the tracks. Even if it could be built it would not be practicable to operate it, for being at a junction point, each train stopping there would not only block the track it occupied but also the tracks of the other road entering the loop at this point from one to three minutes, depending on the length of stop, instead of 45 seconds as at present. Instead of increasing the capacity of the loop such a scheme would only decrease it. The plan of building transfer stations at the junction points was thought of by me at one time but soon abandoned when analyzed.

BION J. ARNOLD.

Benjamin M. Harrod.

The accompanying portrait of Commissioner Harrod was not available in time for publication with the rest of the Isthmian board, last week. Mr. Harrod is the only member of the original commission reappointed by President Roosevelt, although Mr. Parsons and Professor Burr were carried over on the advisory board. He was graduated from Harvard in 1856; was made Chief Engineer of the State of Louisiana in 1877, and City Engineer of New Orleans in 1888. He is perhaps best known for his work in the construction of the remarkable drainage system of New Orleans; a unique problem because the level of the city is lower than the level of the river. Mr. Harrod was placed in charge of that work in 1895. He has been a member of the American Society of Civil Engineers since 1877, and was President of the society in 1897.

Benjamin M. Harrod.

American Railway Association.

The spring meeting of this Association was held in New York April 5, 112 representatives being present. The committee on train rules submitted a code of rules for the operation of trains on three and four tracks, which were adopted. It also reported rules for governing the movement of trains with and against the current of traffic on double track by means of block signals. The advisability of a general revision of the Standard Code of Train Rules for single and double track having been suggested the committee was requested to undertake such a revision and report as soon as possible.

The committee on car service reported that it had not yet completed the consideration of the question of the transfer of carload freight at junction points. If, as it is believed, the external dimensions of the standard box car shall be determined before the next meeting of the association, the committee hopes that certain standard clearances can be recommended.

The committee believes that there is an opportunity for improvement in the penalty rule. The amendment to Rule 6, as adopted at the last meeting of the association, has, however, been in effect such a short time that it seemed unwise to propose any further change at the present date.

Increased experience with the per diem rules has led to improved methods of checking per diem reports on a large number of the railroads of the country, and many companies are now checking reports received as long ago as 1902. The committee presented for passage an addition to Rule 11, which will have the force of a statute of limitation, the term selected being one year; this amendment to go into effect on July 1, 1905, and not to be retroactive. The addition is to the effect that corrections or omissions in per diem reports must be presented within one year. It was adopted.

The committee on safety appliances reported that on Jan. 1, 1905, of the 1,240,628 freight cars in service, 1,091,223 were equipped with air-brakes. Rules to govern the determination of physical and educational qualification of employees were presented by the committee and adopted by the Association.

The committee on statistical inquiry reported progress in the preparation of a working form for keeping statistics of freight transportation. It has been so far completed that the members of the committee have undertaken to test its efficiency under actual working conditions.

The committee on standard cipher code has continued the elimination and condensation of phrases in conjunction with the International Cable Directory Co.'s expert, and the number has been reduced to 25,000 from a total of more than 100,000 originally compiled. The work has required more time and greater care than was anticipated. The following officers and members of committees were elected: President, Stuyvesant Fish (Illinois Central); Second Vice-President, W. H. McDoel (Chicago, Indianapolis & Louisville); Members of Executive Committee, J. Kruttschnitt, Southern Pacific, and H. U. Mudge, Atchison, Topeka & Santa Fe. The next meeting will be held in Chicago, October 25.

New South Wales Railroads.

The report of the New South Wales Railroad Commissioners for the quarter ended Dec. 31, 1904, shows that the miles open for traffic were 3,280, and the revenue for the quarter $4,962,250, compared with $4,618,210 for the corresponding quarter of the previous year, an increase of $344,040. Expenses show a decrease of $70,480, and net earnings an increase of $414,519, an evidence of the improved condition of the country, and the care exercised in the management of the lines. The increase was largely due to the increased earnings of $123,269 from the carriage of agricultural produce, and of $126,695 from the direct pastoral traffic in wool and live stock. The agricultural industry is making great strides in New South Wales, and the present proposals of the Government to throw open additional areas for closer settlement will be the means of large-

ly increasing the output in the near future. The area under crop for wheat alone is estimated at 1,584,975 acres, and is nearly all within convenient distance of a railroad. The wool traffic shows an increase of $71,199, the number of bales carried, compared with the previous season, being an excess of 123,247 bales. Live stock shows an increase of $55,302. The mild winter assisted in the increase in the percentage of the lambing, which was a good one. There were also increases in general goods of $53,712 and in minerals of $19,794. Over 250,000 more passengers were carried, a satisfactory feature being an increase in the number of first class passengers. The total revenue received for passenger and parcels traffic was increased by $23,678. The proportion of expenditure to earnings shows a fall from 65.82 per cent. to 59.84 per cent. A list of 13 special rates granted "to equalize rates and encourage traffic" accompanies the report. The State-owned tramways are managed by the Railroad Commissioners, and comprise 125 miles of line, mostly worked on the electric system. For the quarter, the earnings showed an increase of $10,979, but, owing to additional charges for relaying, etc., debited to working expenses, the expenditure increased to the extent of $50,889. Passengers carried were 36,119,113, an increase of 509,908 upon the previous corresponding quarter. Revenue earned was $1,020,240.—*London Times.*

The Cuyahoga Valley Viaduct.

BY G. H. TINKER.
Bridge Inspector, N. Y., C. & St. L.

The renewal of a portion of the Cuyahoga Valley Viaduct on the line of the New York, Chicago & St. Louis Railroad at Cleveland, Ohio, presented a number of unusual problems in design and erection. The Cuyahoga river runs parallel to the viaduct nearly its whole length, and passes under a draw span at its western end. The Baltimore & Ohio follows the river a part of the distance at a higher level, and, with the river, is crossed by the Wheeling & Lake Erie. These two roads are in turn crossed by the Nickel Plate at a higher elevation. Crossing over all of the above structures is the Central viaduct. This belongs to the city, and it carries a double-track electric road across the valley, in addition to a highway. There are, therefore, within the space of half a mile, five different lines of traffic intersecting each other at as many different elevations.

The Cuyahoga Valley viaduct is a double-track structure, 2,988 ft. long, and includes, besides the ordinary type of iron trestle, a drawbridge 223 ft. long, three 120-ft. truss spans, one 140-ft. span, and several others varying from 75 ft. to 100 ft. in length. At the crossing of the Baltimore & Ohio a series of skew spans had been used, the skew being such that the pier under one truss came opposite the second panel point of the opposite truss. This arrangement (see Fig. 1) permitted one side of the bridge to deflect while the opposite side was rigidly supported. The natural result was that the sway rods between the trusses received a portion of the live load, and were occasionally broken. In addition to this defect in design the top chord was made continuous over these piers, with the result that as an engine passed over the pier the main diagonals pulled first on one side of the post and then on the other, and when taken down the groove worn in the pin by this alternate motion was found to be 3/8 in. deep (see Figs. 1 and 2). For these reasons, this portion of the viaduct was selected for renewal first, and the erection of 271 lineal ft. of the structure at this point has just been completed.

Fig. 1 shows a plan and elevation of the line at the site of the renewal, and it will be seen that the Baltimore & Ohio passes with a 17 deg. curve first under a small highway bridge carrying Canal street, and then under the viaduct. Canal street also passes under the viaduct, one end of the highway bridge being under the south track on the viaduct. The traffic on this bridge is very heavy, with almost a continuous stream of teams passing over it from or to the warehouses and factories in the neighborhood. While there are three tracks underneath the bridge, none of them could be abandoned, as the road is double-tracked, and handles a large business, and the third track is in constant use as a loading track for the Cleveland Provision Co. On the viaduct itself the traffic is very heavy, 64 movements of trains over the work having been counted in eight hours. Under these conditions it can be seen

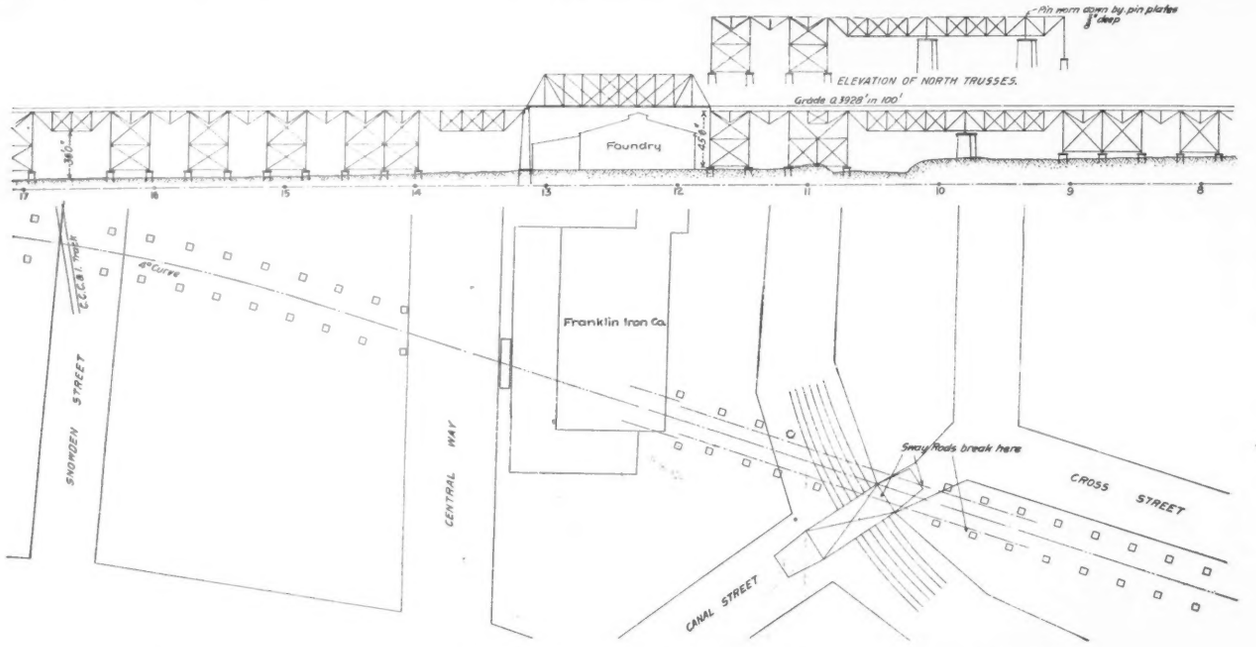


Fig. 1—Plan and Elevation of Old Cuyahoga Valley Viaduct at Cleveland—N. Y. C. & St. L.

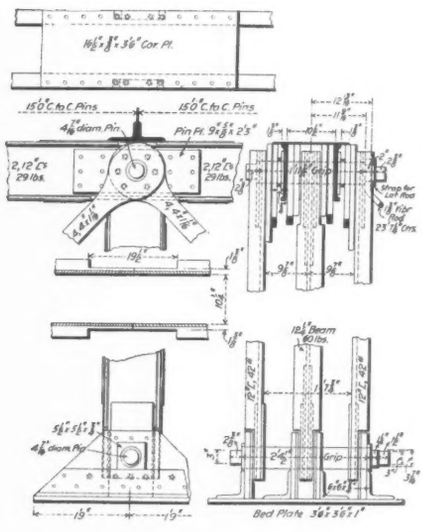


Fig. 2—Details of Pin Connections for Main Diagonals in Old Structure.

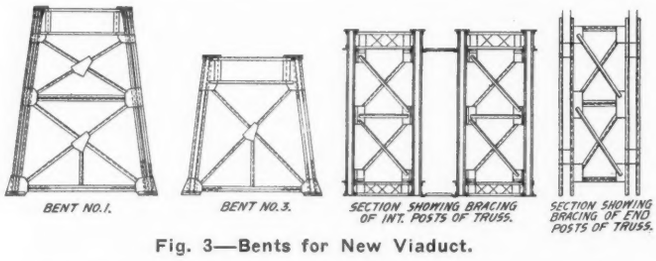


Fig. 3—Bents for New Viaduct.

that the erection was not an ordinary problem, and required not only a large amount of study, but also the utmost care in its execution.

The design of the new structure is shown in Fig. 4. It was necessary to adhere quite closely to the old location for the masonry, and the shallow headroom over the highway did not permit an economical depth for the trusses. Besides these limits, it was further desired to square up the bridge and to build the structure so that any unsymmetrical loading would not cause undue strain. It was also necessary to maintain traffic. It therefore seemed best to design a structure that would permit either track to be carried independently, and thus greatly facilitate the erection. These conditions were met by building two independent riveted deck spans, spaced 12 ft. 6 in. centers, and 125 ft. long, from center to center of end pins. The trusses of each span had to be spaced 7 ft. 6 in. centers, which made a pretty small ratio of width to length, and so the bearing points were placed under the line of the top chord, and the inner trusses well braced together to insure lateral stability. This bracing, it will be seen, lies wholly in horizontal planes, so as to transmit no vertical load from one span to the other. This arrangement proved very satisfactory, the amount of vibration under traffic being almost nothing.

The balance of the structure consists of four lines of deck plate girders spaced the same as the trusses, all carried by three two-bent towers. The foundations for the tower posts consist, in part, of the old masonry footings, which were in excellent condition,

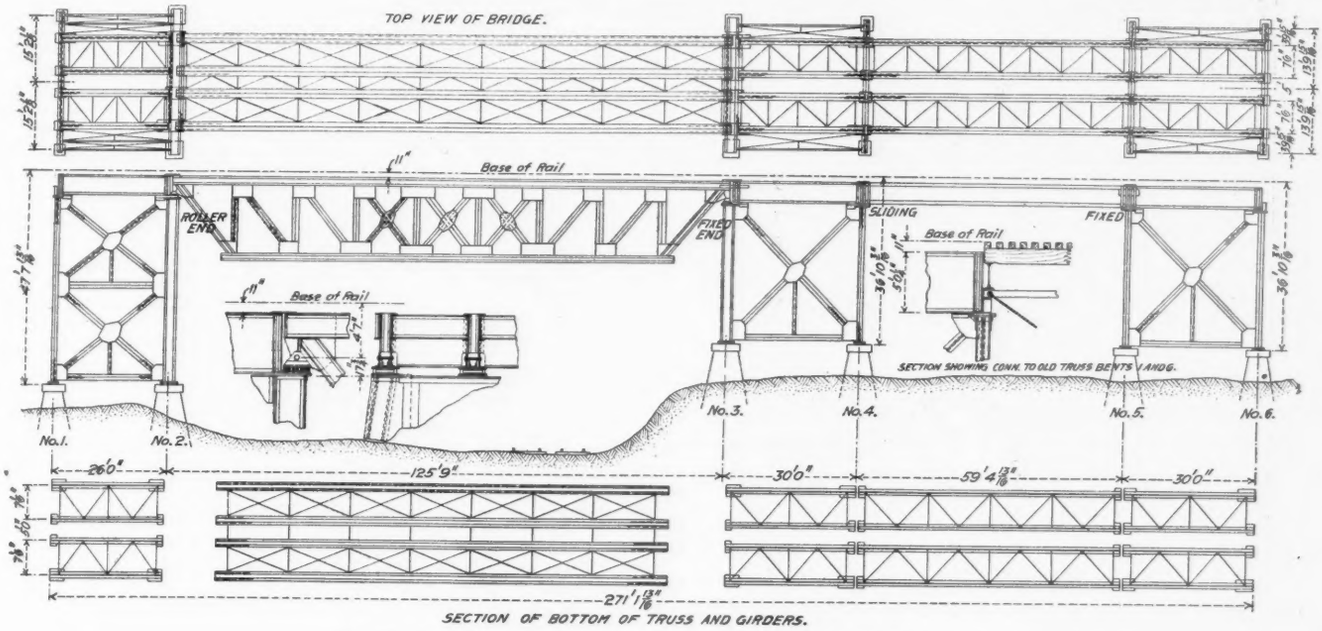


Fig. 4—Details of New Cuyahoga Valley Viaduct at Cleveland.

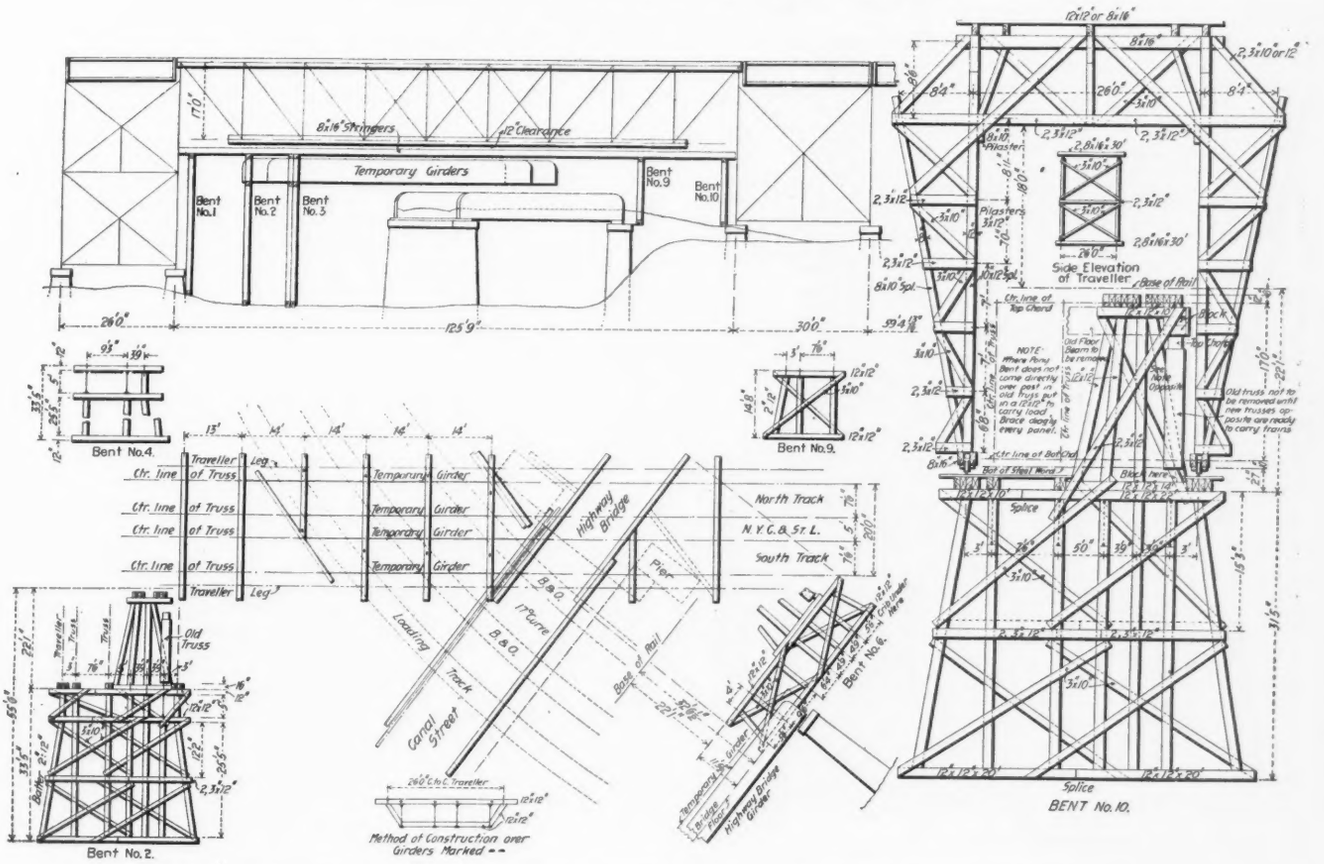


Fig. 5—Falsework and Traveler Used in Erecting New Cuyahoga Valley Viaduct at Cleveland.

and the balance of new concrete footings.

A plan of the falsework is shown in Fig. 5. In order to provide a support across the Baltimore & Ohio tracks, the four 60-ft. girders were placed as shown, two resting on timber bents, and two resting with one end on one of the bents, and the other end on a fifth 60-ft. girder, built for a bridge at Lorain, placed across the highway bridge at one side of the roadway, as shown in Fig. 6.

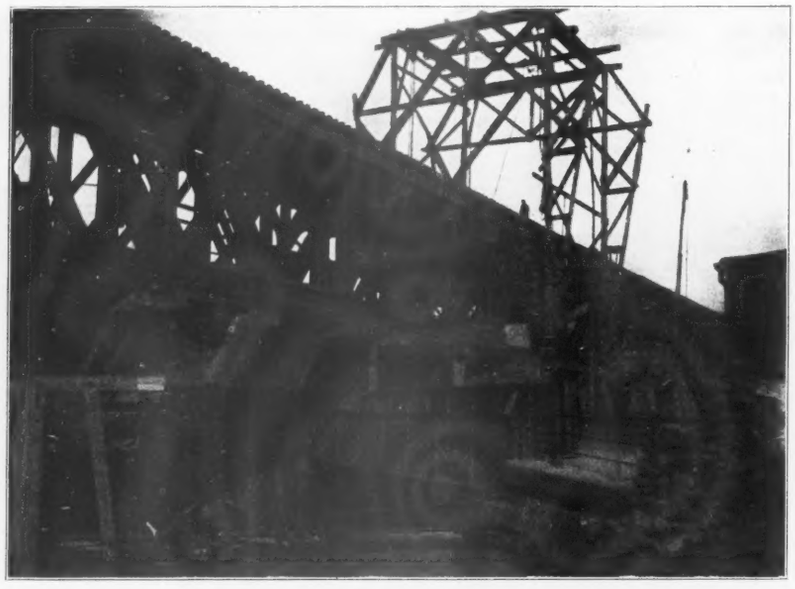


Fig. 6—Traveler and Supporting Girders Used in Erecting New Viaduct.

After the falsework was in place the south track was abandoned, the westerly tower taken down, and the new tower erected. The north track was supported by pony bents under the track stringers, and the south track and floor beams removed. Since the north truss was relied upon to carry a part of the live load after the south truss was removed, great care was exercised to keep it securely braced in its upright position. This was accomplished principally by tying it with wooden braces and bolts to the deck of the falsework. The south pair of the tower girders was next placed, followed by the erection of the south span. The north posts in the tower at the east end of the span could not be erected until the old masonry had been removed, so the south posts and cross-girders were placed, and the free ends of the girders supported upon pony bents on the falsework. Riveting followed closely upon erection. The span was swung before riveting the top chord, after which it was again blocked up, the south pair of 30-ft. tower girders erected, and the south track laid up to this point. Traffic was then turned to this track, and the north track abandoned. The north truss was then removed and pony bents placed under the remainder of the south track. The old masonry piers were removed, and the two north posts of the tower at the east end of the span placed, and the free ends of the cross girders connected to them, the erection of the south span being carried on simultaneously. The east tower was erected and all the south tower girders placed. As soon as the south span had been riveted and swung, the removal of the 60-ft. girders from the falsework was proceeded with. The deck of the falsework was cleared away, the girders for the north track lifted by a derrick car with a 50-ft. boom, the car moved forward, and the girders lowered into place. The north track was now completed and traffic again turned to this track. The remainder of the old structure was removed and the two remaining 60-ft. girders lifted and placed in the same manner as the first two, the last two 30-ft. tower girders placed, and the south track completed. The details of the floor are shown in Fig. 7, all timber being white oak.

Work began with the raising of the falsework on Nov. 14, 1904. The first steel was placed Dec. 8, and riveting was started on Dec. 14. Everything was completed, including the loading of the old structure and all timber, on Feb. 21, 1905, just 100 days from the starting of the work, including several days lost on account of bad weather. The erection was done by the Pittsburg Construction Co., and the workmanship was excellent. By careful attention to blocking up the chord points at the correct elevation the camber in the trusses was maintained perfectly. There were 18,869 seven-eighths-inch steel rivets driven in the field, the average day's work for a gang of four men being 192 rivets, 315 being the maximum, all hand driven. The defective rivets amounted to a little less than 2 per cent.

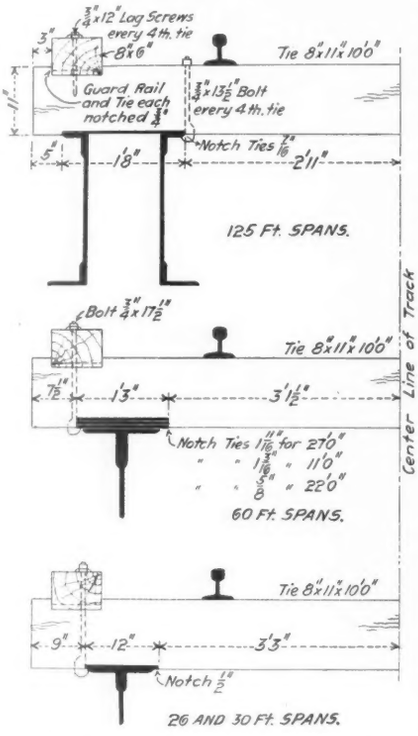


Fig. 7—Details of Floor on New Viaduct.

The shop work was done by the King Bridge Co., of Cleveland. Mr. A. J. Hines is Bridge Engineer of the New York, Chicago & St. Louis, and Mr. E. E. Hart is Chief Engineer.

The Tool Builders' Convention.

The semi-annual convention of the National Machine Tool Builders' Association was held at the Arlington hotel, Washington, D. C., April 11 and 12. About 25 members were present, including the following: L. M. Anderson, Cincinnati Shaper Company; F. W. Boye, Jr., Schumacher & Boye; B. B. Quillan, Cincinnati Planer Company; H. L. Flather, Flather & Company, Inc.; C. S. Guigrich, Cincinnati Milling Machine Company; G. O. Gridley, Windsor Machine Company; F. L. Eberhardt, Gould & Eberhardt; C. H. Alvord, The Hendley Machine Company; M. Shipley, Dietz Machine Tool Company; E. M. Woodward, Woodward & Powell Planer Company; Wm. Lodge, Lodge & Shipley Machine Tool Company; P. E. Montanus, Springfield Machine Tool Company; E. Earle, P. Blaisdell & Company; W. P. Davis, W. P. Davis Machine Company; V. F. Prentice, Prentice Brothers Company; J. W. Carrel, Draper Machine Tool Company; W. A. Wilson, Rochester, N. Y.; O. N. Flather, Mark Flather Planer Company; J. S. Detrick, Detrick & Harvey Machine Company; E. P. Bullard, Jr., Bullard Machine Tool Company; H. Hoeffinghoff, Bickford Drill & Tool Company.

The most important discussions during the meeting were on the subjects of motor driving for machine tools and on conditions of trade. The discussion on motor driving was opened by Wm. Lodge, of the Lodge & Shipley Machine Tool Company. Mr. G. H. Condict, of the Electro-Dynamic Company, was invited to speak, and he called attention particularly to the great economy in the first cost of a machine shop which could be obtained if motor drives were used. He cited a case where a power plant had been designed for a belt-driven shop, and after motor drives had been substituted for the belt drives it was found that the power requirements had been halved. Experience also shows that it is difficult and practically impossible to keep belts at the proper tension for economical working. When belts are new they are usually laced too tight, and as soon as they are run a short time they then become too loose and slip. The use of variable speed motors eliminates gearing and also gives a constant efficiency. Tools can also be worked at all times at maximum capacity. He thought the day was not far distant when belts will not be mentioned in connection with machine tools.

Mr. W. P. Davis, of the W. P. Davis Machine Company, spoke on "Conditions of Trade." He said in part: At our meeting in New York, Nov. 11, 1903, we considered the subject of how shall we improve trade. It was thought at that time by all familiar with the conditions, that we must find a market for our machines outside of our own country, and that we would have to work hard to hold trade we had secured abroad. It is conceded that our machine tools are more accurate and convenient to operate than those made in Europe, and especially small machines such as lathes, drills and milling machines; but our foreign cousins are not slow to copy and manufacture popular American machines, and the advantage they have

in the saving of transportation and duty is a serious problem.

We have found a marked change in the orders received in the past year. The demand for large tools is comparatively light, while there is a fair call for the medium and small machines, such as engine lathes from 10 in. to 18 in. swing; drills from 12 in. to 24 in. swing; shapers from 10 in. to 20 in. stroke, and planers from 16 in. to 16 in. to 30 in. x 30 in. There is also an excellent demand for new special machine tools that will produce better work and lower the cost of production. Machine tool builders throughout the country that are making good tools and who are well known, have been well supplied with orders. Our European trade for the past year has remained about the same as in 1903, except for the large orders placed by Japan.

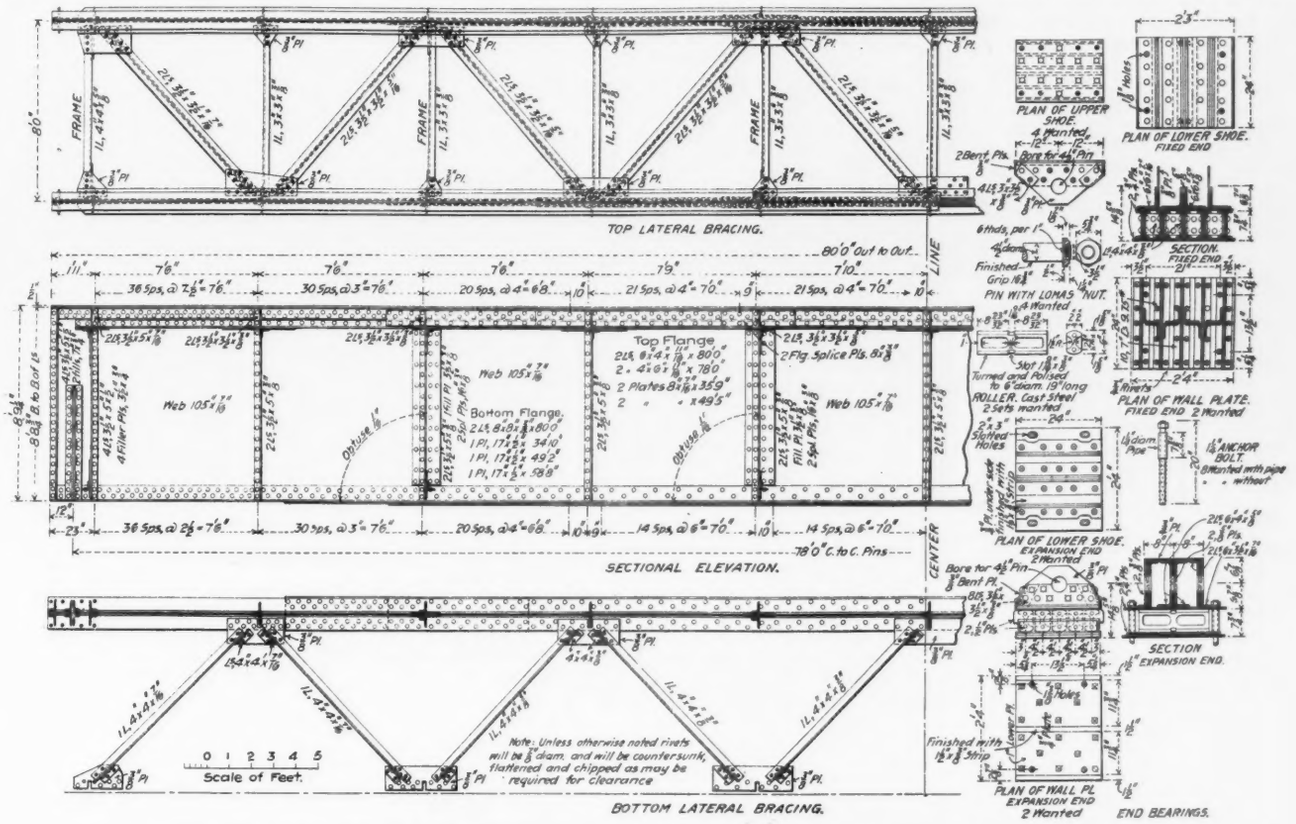
If we expect to get a reduction on the duties charged by any of the European countries we must expect to be more liberal in our own policy, as in some cases the duty imposed by the United States is so unreasonable as to bring about retaliation, as in the case of Russia, where the duty is so high that it practically excludes us from the sale of our products while the Germans are favored. A large part of this trade would come to us were it not for the prohibitive tariff. Russia and Japan are markets we need and every obstacle must be removed to enable us to get our share of business in these two countries.

The Great Central has introduced another novel convenience for its passengers at the larger stations along the line. A message or bulletin board has been erected in a prominent place on the station platform and messages can be attached to this board and left until called for. If it were not convenient to meet one's mother-in-law from the country when she arrived, full directions for finding the house could be left on the message board and no offence be taken even by the most particular relative.

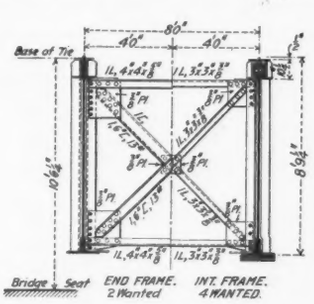
Standard Bridges on the Harriman Lines.*

The bridge shown herewith is the standard 80-ft. deck plate girder span which is 8 ft. 8¾ in. deep, back to back of flange angles. The web plate is cut in five parts and cambered $^1/_{16}$ at each splice, but in other details this girder is exactly similar to the 70-ft. span shown last week. In the top flange the area of section is 36.14 sq. in., and in the bottom flange 51.88 sq. in. The weight of one span is 87,800 lbs.

For all bridges of 80-ft. span or more, expansion end bearings have been designed,


TOP LATERAL BRACING.
SECTIONAL ELEVATION.
BOTTOM LATERAL BRACING.
Scale of Feet.
Note: Unless otherwise noted rivets will be ⅞ diam. and will be countersunk, flattened and chipped as may be required for clearance
PLAN OF UPPER SHOE. 4 Wanted.
PLAN OF LOWER SHOE. FIXED END
SECTION. FIXED END.
PLAN OF WALL PLATE. FIXED END 2 Wanted
PLAN OF LOWER SHOE. EXPANSION END 2 Wanted
SECTION EXPANSION END.
PLAN OF WALL PL EXPANSION END 2 Wanted
END BEARINGS.

General Drawing of Standard 80-ft. Deck Plate Girder and Details of End Bearings—Harriman Lines.



Cross Frames of 80-ft. Girder.

and these are shown in complete detail in the accompanying drawings. The top shoe rests on a nest of five cast-steel rollers having top and bottom surfaces turned and polished to 6 in. diameter. These rollers bear on the fixed wall plate, which is finished with a raised guide strip in the center, and flanges on each side to hold the rollers in a line. The fixed end rests on a bed of 7-in. channels riveted to the top of the wall plate.

*Previous articles appeared in the *Railroad Gazette*, March 17, 24, 31 and April 7.

The Model Ticket Office.*

The Union Station ticket office has 41 ticket windows. Its latest development is the floor walker, or human encyclopedia of ticket information. This officer relieves the congestion at any window as soon as it manifests itself, by distributing the patrons to other windows. When a buyer requests a ticket for a long distance coupon point, requiring numerous skeletons or other complicated forms, the floor walker becomes the seller's assistant and makes up his ticket. Meanwhile the seller has kept up with all of the sales at his window, without any delay or interruption. The floor walker patrols the office constantly behind the sellers, untangles the many knotty problems which arise, promotes the rapid handling of business, soothes the irritable traveler and speeds him on his mission, pours oil on the troubled waters, settles disputed points between sellers and patrons and saves an endless correspondence by quick and incisive decisions. He will take charge of any window from which the regular seller may be called away in case of emergency, or open a window on his own account. This idea proved so successful that we now employ our most experienced ticket sellers for this exclusive purpose, and the knowledge that a ready and willing, guiding or helping hand is always within reach creates incalculable confidence among the ticket selling force.

The stock clerk keeps on hand 2,481 local forms and 5,892 coupon forms, and the longest coupon ticket is 76 in. long. The reserve stock is kept in cabinets, containing drawers of convenient sizes. The selling cases are filled from this reserve stock in consecutive numbers. Card tickets are filed according to the rate, and coupon tickets according to the alphabetical initial of the line which delivers

*Abstract of a paper read before the St. Louis Railway Club, Jan. 13, by B. W. Frauenthal, Ticket Agent, Union Station, St. Louis.

the passenger at destination. The ordering and keeping of this stock, sufficient to meet demands at all times, requires application, experience, knowledge, and the patience of genius. If too many tickets are ordered the lines find fault. If not enough are ordered, the ticket seller must write a blank or skeleton form.

Under the subject of Ticket Rating and Classifying, I need the eloquence of Bishop Potter to move our hard, unrelenting General Passenger Agents to compassion for our long and patient suffering. . . . . The speaker then went on to show how conflicting rates to small towns a long distance from St. Louis often make it difficult to fix the right price for the passenger; and small discrepancies are on this account frequently reported from the auditors' offices. These make small, but unjust and unnecessary financial burdens on the ticket sellers. . . . In our office we have every passenger association rule to observe and every one of the 22 roads to follow in the various changes. Each of these lines is competitive with at least one or two others at some point, sometimes near St. Louis, and other times in territories hundreds of miles distant. This office, as a representative of each of the individual lines, is required to see that all of them are promptly notified when any of their competitors are underselling them to any point, or securing business by authorizing more liberal limits or arrangements for ticketing any particular class of business.

Every seller in our station has a Centennial dater, which records the individual number of selling check, a Jones cutter for local or card tickets, which detaches the auditing stub, impresses the date and makes an individual check record in the same operation, a Cummins perforator, which perforates the selling date and individual check, a ticket "L" punch, a one-half and second class punch, an individual cash drawer containing his floating cash, a St. Louis rate sheet file, a daily revised compiled tariff of all the local points on the 22 roads, and an assortment of rubber stamps. In the selling of tickets, ample scope is given each seller for the employment of his judicial temperament. We render blind-folded justice to the tenant lines. The seller names every line to a competing point when called upon to do so, but in no case is he allowed to even suggest any initial line. After the buyer has named his route, our endeavor is to give the initial line the long haul. The necessity of impartiality in the treatment if this feature of our business may be realized when you consider that the same seller may supply in rotation a ticket to New York, San Francisco, Duluth or New Orleans. You may buy a ticket from the same window for five cents to Tower Grove and for $243 to Port Arthur. . . . The sales at the Union Station in 1894 amounted to $1,286,691; in 1904 they amounted to $4,701,232.

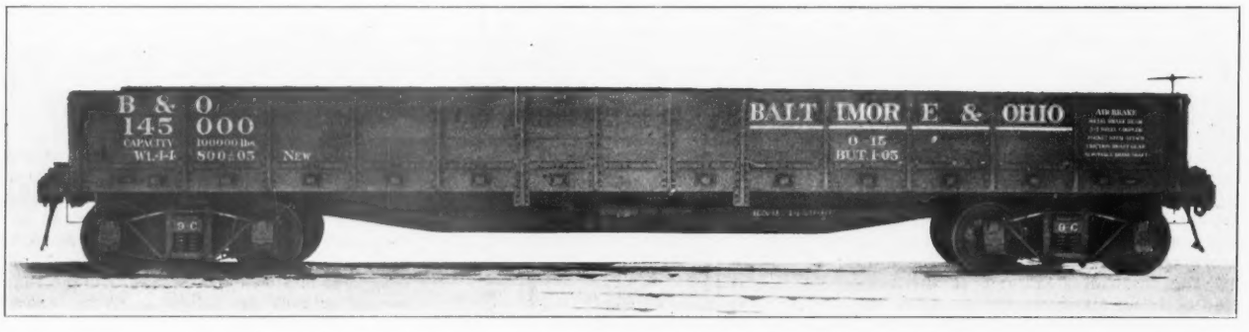
In our Ticket Accounting Department you will observe 11 desks—nine of which are designated by letters from A to I, the other two being used by the Chief Accountant and his Assistant. The lettered desks are used as a clearing house for auditing the ticket sales of an individual road, or a number of roads, as the volume of business may demand. Thus we find desk "A" handles all local and coupon sales for the Burlington Route and the bridges; desk "B" handles all the sales for the Illinois Central, Vandalia, Southern and Clover Leaf, and so on. All ticket sellers furnish a report every day of the sales belonging to the roads represented at each desk, and they must, therefore, divide their general day's sales into nine separate reports. These reports are enclosed in an envelope, with the auditing stubs, exchange orders, authorities, etc., and are marked with the address of the particular desk to which they belong. The Accountant checks the rate and the entire report against the stubs, and then makes a complete report of the total day's sales to each individual line, carrying the general totals to the Chief Accountant's desk, where a summary of ticket sales is made and compared with the cash remitted by each seller, and the general daily balance of the office is thus determined. The relation between the accounting department and the selling department of this office is similar to that of any railroad in its relation between the Auditor and its station agents. We post for general office inspection an epitome of ticket sales, cash accounts and credits or debits, which serves the purpose of keeping each seller cognizant of his standing with the office. The accountant then makes a detailed report to each road of the business of the office, under such requirements as each road imposes. Some of these roads require daily reports, some weekly reports, some monthly reports, and some roads —to emphasize their individuality or vary the monotony—require them daily, weekly and monthly, with an occasional daily telegram of the receipts thrown in. The joint ticket agent keeps a daily report of the receipts of each road, and remits to balance these receipts four times every month.

We have absorbed the duties of the Bureau of Information, and additional success has been attained under the reorganization. The telautograph has been installed, by which the movement of trains is electrically registered in writing. The original written record is autographically transmitted as instantly as it is recorded at the sending station [the signal tower]. We, therefore, have a written record which easily hastens our ability to impart valuable information. In the Union Station the conditions are peculiar, made so by the many different lines entering it, and simple rules are complicated by the many different methods which control. All these rules are comparatively simple in purpose, but the multiplied forms of handling the same character of business create a confusion of details almost alarming in the many branches. In the Model Ticket Office, every man prays daily, dreams nightly and hopes eternally for a standard rule governing the form, sale and issuance of tickets. I am persuaded to invite a general investigation of the English system of booking passengers and auditing the sales. We have expanded our railroads in such a wonderful degree that I am afraid we have come to believe that our systems are perfect. A brief observation of the English idea shows many features which we may well adopt. For instance, the English system of the ticket clearing house makes it practicable to handle coupon business on printed card tickets, in which the revenue is apportioned by punch marks. This might do to unify the systems of any passenger association to control the form of ticket within the limits of its own territory.

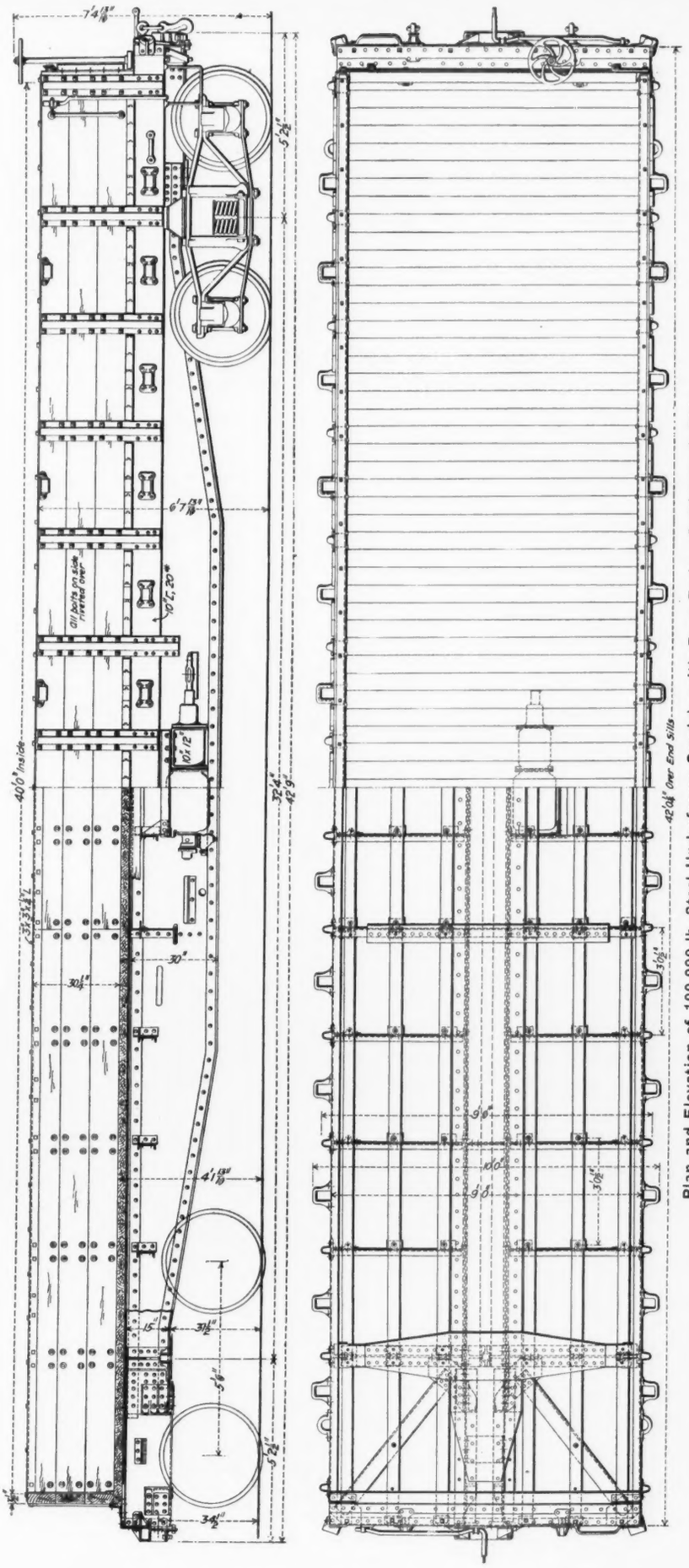
The business of ticket selling demands the highest type of individual intelligence and extraordinary training, and as a reward for the highly talented seller, I am at a loss to determine whether he should be made an honorary member of the International Geographical Society or be recommended to the President for appointment as the leading exponent of the "Simple Life." That air of superiority or independent indifference sometimes met with at the ticket window is but the expiring gasp of a passing custom. The ticket seller of to-day to be successful, must possess: 1, honesty; 2, gentlemanly conduct; 3, sobriety; 4, politeness; 5, patience; 6, intelligence; 7, neatness; 8, patience; 9, politeness; 10, good habits; 11, patience; 12, politeness. If the ticket seller meets the capricious buyer, he should conquer his wrath with a soft answer; he should not meet temper with argument, which increases it. One fool within 20 ft. of a ticket office is all that even the greatest railroad corporation can afford.

Steel Underframe Gondolas for the B. & O.

The Baltimore & Ohio has recently received from the Standard Steel Car Company, Pittsburg, Pa., 1,000 steel underframe, drop-end gondolas of 100,000 lbs. capacity which embody some new ideas in car design. There are in service on this road several thousand 100,000-ton steel underframe gondolas with wooden bodies which are quite similar in all their details to the Pennsylvania class Gr gondolas, described in the *Railroad Gazette*, Oct. 10, 1902. These cars have four fish-bellied longitudinal sills of pressed steel, 24 in. deep at the center. A recent modification of that design on the Pennsylvania uses structural steel, built-up sills of the same depth and practically the same section modulus. In the car shown in the accompanying illustrations, the center sills are designed to carry the entire load and the depth in middle has been increased to 30 in. This principle is, of course, not new, having been employed in other designs using two heavy channels, or I-beams, for sills. The use of a fish-belly girder built



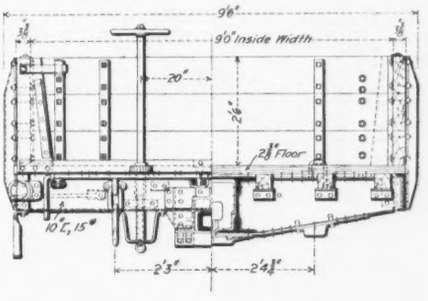
Fifty-ton Steel Underframe Gondola with Drop Ends—Baltimore & Ohio.



Plan and Elevation of 100,000-lb. Steel Underframe Gondola with Drop Ends— Baltimore & Ohio.

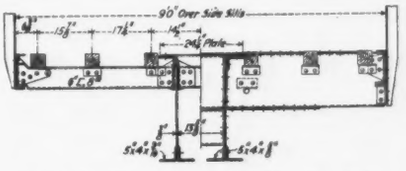
up of plates and angles and 30 in. deep, is, however, a departure from previous practice.

These new cars are 40 ft. long, 8 ft. 5¼ in. wide, and 2 ft. 6¼ in. high inside. The underframe is essentially a stiff central column with ribs extending out to both side sills at intervals of about 3 ft. to transmit the floor loads to the center of the car. The two center sills are spaced 13⅝ in. apart and are made up of web plates ⅜ in. thick with 4-in. x 5-in. inside and outside bottom flange angles and 4-in. x 5-in. outside top flange angles. A top cover plate $^{7}/_{16}$ in. thick extends the length of the car and is continuous over the bolsters. The sills are 30 in. deep for 13 ft. in the center of the car, tapering to 15 in. over the bolsters. Just outside the bolsters the sills are spliced to 16-in. channel draft sills. The side and end



End Elevation of 100,000-lb. Gondola.

sills are 10-in., 20-lb. channels, with flanges turned in. Between the bolsters the side sills are connected with the center sills by eight intermediate cross-bearers and two main cross-bearers near the middle of the car. The intermediate cross-bearers are 6-in., 8-lb. channels riveted to angle brackets on the center sills and resting on the lower flange of the side sills. The main cross-bearers are pressed steel channels 14 in. deep built around the center sills like the bolsters and extending their full depth out to the side sills to which they are securely riveted. The neutral axis of the center sills is almost in the center of the web plates, or 3½ in. below the center line of draft. This would tend somewhat to increase the compression in the upper fibers under buffing shocks, but the strength of the girders is ample to take care of this additional stress. In designing the



Cross-Sections of 100,000-lb. Gondola.

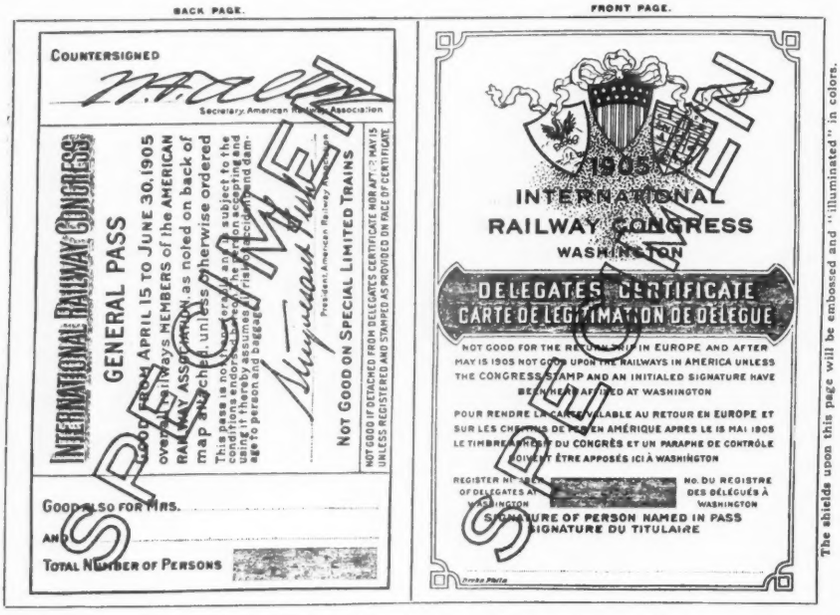
required sections a distributed load of 125,000 lbs. and a concentrated load of 83,000 lbs. were assumed.

The floor of the car is of 2½-in. planks laid on 3½-in. x 3½-in. nailing strips bolted to brackets on the intermediate cross-bearers. The sides are made of three 3½-in. planks bolted to the pressed steel side stakes which are riveted on the outside of the sills at each connection of the cross-bearers. A 3-in. x 3-in. x ¼-in. square root angle is lag screwed on the upper inside corner of the sides for a finishing strip. The ends are arranged to drop, being hinged at the bottom and held at the top with a simple latch. The weight of the cars is 44,300 lbs.

We are indebted to Mr. J. E. Muhlfeld, General Superintendent of Motive Power, Baltimore & Ohio, for the drawings.

A Comprehensive Pass.

The accompanying cut shows two pages of the most extensive pass that was ever issued, and we lay it before our readers as a curiosity for railroad men and a temptation for legislators and other people who dote on passes. On one of the pages of the pass there is pasted a folded outline map of the railroads of America on which the pass will be


BACK PAGE.
FRONT PAGE.
COUNTERSIGNED
Secretary American Railway Association
INTERNATIONAL RAILWAY CONGRESS
GENERAL PASS
GOOD FROM APRIL 15 TO JUNE 30, 1905
over all railways MEMBERS of the AMERICAN RAILWAY ASSOCIATION, as noted on back of map attached, unless otherwise ordered
This pass is not transferable, and is subject to the conditions endorsed hereon. The person accepting and using it thereby assumes all risks of accident and damage to person and baggage.
President American Railway Association
NOT GOOD ON SPECIAL LIMITED TRAINS
NOT GOOD IF DETACHED FROM DELEGATE'S CERTIFICATE NOR AFT. 2 MAY 15 UNLESS REGISTERED AND STAMPED AS PROVIDED ON FACE OF CERTIFICATE
GOOD ALSO FOR MRS.
AND
TOTAL NUMBER OF PERSONS
SPECIMEN
1905
INTERNATIONAL
RAILWAY CONGRESS
WASHINGTON
DELEGATE'S CERTIFICATE
CARTE DE LEGITIMATION DE DELEGUE
NOT GOOD FOR THE RETURN TRIP IN EUROPE AND AFTER MAY 15 1905 NOT GOOD UPON THE RAILWAYS IN AMERICA UNLESS THE CONGRESS STAMP AND AN INITIALED SIGNATURE HAVE BEEN HEREON AFFIXED AT WASHINGTON
POUR RENDRE LA CARTE VALABLE AU RETOUR EN EUROPE ET SUR LES CHEMINS DE FER EN AMÉRIQUE APRES LE 15 MAI 1905 LE TIMBRE AMBULANT DU CONGRÈS ET UN PARAPHE DE CONTRÔLE DOIVENT ÊTRE APPOSÉS ICI À WASHINGTON
REGISTER NO. OF DELEGATES AT WASHINGTON
No. DU REGISTRE DES DÉLÉGUÉS À WASHINGTON
SIGNATURE OF PERSON NAMED IN PASS
SIGNATURE DU TITULAIRE
SPECIMEN
The shields upon this page will be embossed and "illuminated" in colors.

Pass for Foreign Railroad Men Traveling in America.

accepted, together with a list of the names of the companies. This document includes also the delegate's certificate to the Congress and a map of the European railroads. Samples of this pass and certificates are sent to all of the railroads in the country for the information of conductors who will have to honor the passes.

Changes in Italian Railroad Policy.*

July first of this year marks the end of the 20 years period during which the Italian railroads, while almost exclusively owned by the government, have been operated under contract with private companies. Previous to 1885 the Italian railroads were owned and operated in a great variety of ways. Some were owned by the government, but operated by private concerns; others were owned by the latter, and operated by the former. Some were owned and operated by the government; others by private companies. As a result of these experiences, the government in 1885 acquired the ownership of the railroads, but farmed out their operation to four great companies (the Southern, Adriatic, Mediterranean and Sicilian Companies) for 75 years, the government, however, reserving the right to terminate the contracts in 20 years, that is in 1905. These contracts have been the source of endless litigation and quarrels. The government beaureaucracy has frequently been accused of dilatoriness in carrying out its share of the agreements with the railroads. Needed extensions have thereby been indefinitely delayed. Through the indifference and mismanagement of the government, needed changes in railroad rates, time-tables and general traffic arrangements have been made impossible. The poor connections between the various lines, the inferior station accommodations and the insufficient rolling stock are largely accounted for in this way.

Neither the government in owning nor the companies in operating the railroads directly assumed the responsibility of renewing and enlarging the equipment and rolling stock. To meet these expenses a series of reserve funds were created by the contracts. These funds were to consist of annual contributions of given percentages of the railroads' gross earnings. These, it was unfortunately assumed, would amount to a certain figure in 1886, and would increase in a certain proportion. In point of fact, the initial figure was put too high, and the increase fell far below the original expectations. For instance, the fund intended to meet the cost of improving and enlarging the railroads' equipment should have amounted to $20,000,000 in 1895. In reality, it barely reached $2,000,000 by that year. As a result of these miscalculations, the roadbed, rolling stock and stations rapidly deteriorated, and have long since fallen far below the requirements of modern railroad traffic. The terminal facilities of such an important port as Genoa are antiquated and very deficient. Elsewhere the roadbed is in a bad condition; the rails are often in a condition dangerous to traffic. The government has had no means to make improvements. At least $100,000,000 is necessary to put the railroads in proper condition. The poor condition of the rolling stock is known to all travelers. In the original contracts of 1885 the life of the cars was put at too high a figure; for passenger cars and locomotives 40 years, for freight cars 60 years. In Prussia the similar figures are 26, 21 and 25 years.

The worst feature of the railroad contracts of 1885 was the fact that they did not encourage the railroads to develop traffic. The contracts provided for much building by the private companies, and the terms were such as to make it more profitable for the companies to build new lines in distinction from operating them in a far-sighted way. Moreover, in providing for a division of profits between the government and the companies a distinction was made between lines that had a gross revenue of $3,000 and more per kilometer and those that had a smaller revenue. The necessary result was that the companies did not encourage heavy traffic. Beyond a certain figure increased traffic was unprofitable to them. By general agreement the arrangement which is now drawing to an end has been unprofitable to both the government and the companies, and harmful to the community. None favored the continuance of the contracts, and they are to terminate in a few months. A new policy is to be inaugurated, by which the government will both own and operate the railroads. This will call for roughly $200,000,000, half of this sum for the purchase of the existing rolling stock, and the other half for impending and necessary improvements. It will be no easy matter to raise this amount by government loans, and there are grave doubts whether government management will bring about a marked improvement in the railroads.

*Abstract of an article in the *Zeitung des Vereins Deutscher Eisenbahnverwaltungen* for February 15, 1905.

A Unique Railroad Relic.

BY W. B. PALEY.

The fate of the Novelty, one of the three engines which competed at the famous trial of locomotives at Rainhill, Lancashire, in October, 1829, has always been one of the mysteries of railroad history. Much interest was therefore aroused among those acquainted with the subject by the announcement, some months ago, that a portion of the engine not only still existed but was even at work.

It is well known that the Novelty failed to pass the tests more through certain unfortunate break-downs than because of bad design, although that design would certainly not have stood the proof of prolonged experience. First a feed-pipe burst, then the packing of a joint blow out. The engine was, however, run experimentally upon the Liverpool & Manchester Railway for some time between the trials and the opening of the line in September, 1830. It was found too light, and was not purchased by the company, and after, probably, a period of disuse, was practically rebuilt in 1833 by Messrs. Watson and Daglish, of St. Helen's, near Rainhill. Messrs. R. Daglish & Co. have been good enough to inform the writer that they have details of numerous small alterations, such as crank pins, connecting rods, etc., ordered for the Novelty by Charles Vignoles, and further, that they made two new cylinders for it, and a new boiler fitted with 75 copper tubes, 3½ in. in diameter. The wheels were all re-turned and fitted with tires, new axles and cranks were made; "in fact," they say, "it seems to us, from the amount of details, as if the engine had been almost re-built." On August 3, 1833, it was put to work on the St. Helen's & Runcorn Gap Railway, a short mineral line running down to the Mersey at Widnes, where docks were built for shipping coal. It is now stated that the engine was ultimately sold to the Preston & Longridge Railway, a short line which ran only to some stone quarries seven miles northeast of Preston, Lancashire, and was opened on May 1, 1840. The question of the kind of power to be used was left open until a few months before that date, but at a meeting held on Oct. 26, 1839, it was decided to employ locomotives. Nevertheless, the line was opened with horse-power and continued under animal traction until June 12, 1848, when an engine named the Addison (after Mr. T. B. Addison, the chairman), was put on. As, except for half a mile out of Preston, the line rose so steeply that the traffic was worked in one direction by gravity only, it seems unlikely that the Novelty could have been of much use upon it. No trace of any trials on the Longridge line can be found in the Preston papers. Possibly the locomotive was intended for the passenger traffic, but this was of the smallest

kind, there being no town at the upper terminus. In fact, it was a long time before passenger trains ran every day, the quarrymen and occasional visitors to Longridge Fells for the sake of the fine views being all there was to accommodate. As in several similar cases, the horse was brought down in a low truck termed a "dandy" at the rear of the train. The line is now the joint property of the London & North Western and Lancashire & Yorkshire Companies.

It seems that when the Novelty was altered in 1833 her old cylinders were given to Mr. John Melling, who founded the engineering works now occupied by the Rainhill Gas & Water Company. Here they remained in partial use till last summer, when one of them was presented to South Kensington Museum. This most interesting relic has only lately been placed on view there, after being carefully cleaned up. It is appropriately situated close to the Novelty's competitors, viz., Hackworth's Sansparlel and Stephenson's Rocket, mounted upon a small table, through the top of which slats have been cut to admit the vertical connecting-rods. These are slung from a horizontal cross-head, running in two guides of round section; they have a small oil-cap forged on

The Novelty.*

the top and are cottered-up with a split key having holes for a cross-pin to prevent it working out. The lever which worked the slide-valves remains, though there is nothing to show whether it was moved by an eccentric or by one of the bell-cranks. On one side of the lever is a notch, just below the handle, into which one of the studs upon a small cross-bar engaged. The cross-bar is fixed on one end of a shaft having two short arms from which rods run up to a cross-head carrying the valve-spindle at its center. The arrangement therefore resembles the main driving gear in miniature. Apparently the lever was held to its work on the stud by hand, one stud, of course, driving one way and one the other. The short arms forged on the shaft are only two or three inches long. The exhaust steam escaped over the sides of the engine by copper pipes, a small portion of the one belonging to this cylinder remains. Whereabouts they ended seems uncertain. As originally built a blowing-box worked from one of the bell-cranks forced air into a closed ash-pan, below the grate, the products of combustion finding their way through a copper coil folded at each end so that it traversed the barrel of the boiler three times. The heating-surface of this coil was only 33 sq. ft., and that of the firebox 9½ more, the grate area being but 1.8 sq. ft. in extent.

The cylinder is a neat little casting, 6 x 12 inside, fixed upon a small cast-iron stand 14½ in. broad by 10¾, and about ½ in. thick. The attachment of the connecting-rods to the bell-crank was inside this stand or pedestal, slots being cut in the top to admit them. Six bolts hold the cylinder to it; the top cover has only four.

The connection of the Novelty with the St. Helen's line is clearly due to C. B. Vignoles, who built the railroad, and at the time of the Rainhill trials was in partnership with Braithwaite & Ericsson, the firm who designed the machine, and in all probability he had a hand in its trial on the Longridge line as well. He was engineer to the North Union Railway, which ran from the Liverpool & Manchester at Parkside, to the town of Preston, and was opened on Oct. 31, 1838. In a biography by his son, O. J. Vignoles, is a quotation from a diary under date May (apparently a misprint for October) 30, "the day before the line was opened," to the effect that he had just been over the Ribble viaduct on the Novelty, the first time he had been over it on an engine. One may be sure the lightest engine procurable would be used for the first trip over a stone bridge of five 120-ft. arches, the centers of which had only lately been struck. Only eight days before the directors, coming from the south end of the line by a special train to hold a formal inspection, had stopped short of the viaduct, walking over it into Preston. No junction was made with the Longridge line, but the directors of it must have known of Vignoles' engine and might easily think she would do for the light work of their line. What they did with it, however, if they really purchased it, still remains a mystery. The Novelty would have made a capital little inspection engine, and it looks very much as if that was actually its occupation. What the dimensions of the cylinders and heating arrangements put in in 1833 were, does not seem to be known, but they could not have been very different from the original ones, consistently with the engine remaining the Novelty. The frame, being a mere platform of wood, and the wheels of suspension type of very light make, would not have borne any considerable increase of weight. The engines on the St. Helen's line were powerful for their time, however, and had to be efficient. Little is known about them, but Mr. Robert Daglish built, engined and worked the line for some years. No drawing of the Novelty in its altered state is known to exist, but the changes undoubtedly made leave it pretty certain that there was not much of the original engine in the machine that timidly ventured over the Ribble viaduct nine years after the memorable era of Rainhill.

*Designed by Braithwaite and Ericsson of London, and tried at Rainhill on the Liverpool & Manchester Railway, Oct. 10 and 14, 1829. Weight empty, 6,160 lbs.; weight full, 8,288 lbs.; cylinders, 6 in. x 12 in.; wheels, 4 ft. 2 in. The Novelty was the first tank engine ever built.

Accident Bulletin No. 14.

The Interstate Commerce Commission has issued accident bulletin No. 14, summarizing the railroad accidents in the United States during the three months ending Dec. 31, 1904. The number of persons killed in train accidents was 242, and of injured 3,298. Accidents of other kinds, including those sustained by employees while at work, and by passengers in getting on or off the cars, etc., bring the total number of casualties up to 14,978 (951 killed and 14,027 injured). These statistics deal only with (*a*) passengers and (*b*) employees on duty.

Table No. 1.—Summary of Casualties to Persons.

Kind.	Passengers		Total employees	
	Killed.	Inj'd.	Killed.	Inj'd.
Collisions	51	899	117	1,089
Derailments	2	495	55	395
Misc. train accidents	..	36	17	384
Total train accidents	53	1,430	189	1,868
Coupling and uncoupling	..	..	71	832
While doing other work about trains	..	..	73	3,178
Overhead bridges	4	5	22	301
Falling from cars or engines, or while getting on or off	45	489	181	2,566
Other causes	12	453	301	2,905
Total	61	947	648	9,782
Total, all classes	114	2,377	837	11,650

The last quarterly bulletin and that issued one year ago (No. 10) were both marked by very high casualty records, so that the present one shows well in comparison with either; but the three most serious accidents in the present record caused 48 deaths. These are collisions 17, 22 and 23. The total of employees killed in accidents other than train accidents (648) is larger than in the last preceding quarter; but the number of men employed in the train service was doubtless larger. As compared with the October-December quarter one year ago, the present total under this head is samller.

Table No. 2.—Collisions and Derailments.

	No.	Loss.	Persons Killed.	Persons Inj'd.
Collisions:				
Rear	445	$498,745	43	685
Butting	215	467,793	89	698
Trains separating	307	142,781	4	108
Miscellaneous	793	367,300	32	497
Total	1,760	$1,476,619	168	1,988
Derailments due to:				
Defects roadway,etc	202	$134,706	9	306
Defects equipment	609	525,340	6	153
Negligence	94	62,776	13	101
Unfrsn obstrctns,etc	51	47,234	7	73
Malicious obstructn.	19	13,374	1	15
Miscel. causes	215	146,032	21	242
Total	1,190	$929,462	57	890
Grand total	2,950	$2,406,081	225	2,878

Collision No. 17, the most disastrous accident in the present record, was between an eastbound passenger train and a westbound freight. It occurred at 4 a.m., and both trains a moment before the collision were moving at about 30 miles an hour. The freight was encroaching on the time of the passenger train in consequence of the failure of its conductor and engineman to observe or heed the green-light signals on a preceding passenger train. The freight train had been waiting on a side track about one hour and 40 minutes, and according to the rules, was to wait there until the passage of

the eastbound passenger train *and all of its sections*. On the first section green lights were displayed to indicate that a second section was to follow, but failing to look for these lights the men in charge of the freight started their train out of the side track immediately after the passage of the first section (which did not stop at that point). The conductor and engineman in charge of this freight were both men of experience. The 29 passengers who were killed were all riding in the foremost passenger car, which was next to the tender of the engine, there being no baggage car in the train.

In connection with collision No. 22 (causing 10 deaths) the officers of the road state that a rule has been issued requiring that hereafter an operator who, after receiving a telegraphic order needs additional copies of it, must, after writing such additional copies, telegraph them to the despatcher and receive the despatcher's "o K."

The third most serious collision, No. 23, killing eight persons and injuring 25, was due to a failure on the part of a telegraph operator whose experience had extended over several years, but whose service had been intermittent and had been on several different roads.

Butting collision No. 7 resulted from negligence on the part of three or more persons. The third section of a freight train passed the first section without the exchange of despatcher's orders between the conductors of the two trains, as is required by rule; and a meeting order was thereby nullified. A copy of the meeting order had been sent to the station at which the opposing train should have been met, but the operator at this station, a man of one year's experience, did not display his stop signal. Soon after receiving the order his tour of duty expired and he went off without giving to the operator who relieved him a notice of the existence of the meeting order.

Collision No. 1 occurred about 6 a.m., and the victims were drovers riding in the caboose of the leading train. Although the block-signal operator appears to have been grossly negligent, the collision would not have occurred but for neglect on the part of others. The line of the road was straight. The foremost train having been stopped, the conductor went back with a red light and put one torpedo on the rail, but before he could go farther and put down another torpedo, the second train (19 cars) was upon him. The engineman of this train did not see the conductor's red stop signal until he was very close to it, because of an electric headlight on a passenger train coming from the opposite direction, the rays of which shone directly in his eyes. Of the 19 cars in the second train only seven had their air-brakes coupled so as to be within the control of the engineman. This train had left the last preceding station ahead of time.

Derailment No. 1 appears to have been directly due to the signalman's lack of acquaintance with his surroundings. Though in the service of the company only three days, he was intrusted with the management (in the night) of the signals at a crossing of one road with another where the two lines approached from one direction on parallel lines close to each other. Derailment No. 3 appears to have been due to a reckless disregard of regulations.

CAUSES OF THIRTY-THREE PROMINENT TRAIN ACCIDENTS (Class A).*

[NOTE.—R.. stands for rear collision: B., butting collision; M., miscellaneous collisions; D., derailment; P., passenger train; F., freight and miscellaneous trains.]

COLLISIONS

No.	Class.	Kind of train.	Killed.	Injd.	Damage.‡	Ref. to record.	Causes.
1.	R.	F. and F.	1	1	$500	47	Operator gave clear block signal when block was not clear. Engineman had control of airbrakes on only 7 out of his 19 cars. (See note in text below.)
2.	R.	F. and F.	2	3	2,140	46	Superintendent reports this as "unavoidable." Leading train had stopped just after emerging from tunnel, because of broken drawbar; flagman heard following train in tunnel, but did not dare enter because tunnel was filled with smoke; regular time interval had been maintained at last station.
3.	R.	F. and F.	1	1	4,538	4	Train approached yard at uncontrollable speed, 11 p. m.; engineman on duty since 8:45 a. m., after rest of 4 hrs. following 12-hr. trip.
4.	R.	F. and F.	1	3	5,000	8	One passenger killed. Failure to flag and poor lookout on engine; flagman on duty 17 hrs. 30 mins., with intermission of 1 hr.
5.	B.	F. and F.	0	7	5,000	34	Engineman forgot meet order; conductor endeavored unsuccessfully to stop train.
6.	R.	P. and P.	4	35	5,110	25	Four passengers killed. Engineman negligent as to signals when approaching a junction.
7.	B.	F. and F.	0	6	6,100	57	Confusion of despatcher's orders. (See note in text below.)
8.	B.	F. and F.	2	1	7,482	35	Despatcher (experience 4 mos. as despatcher, 4 years as operator) sent meeting order to only one of the two trains.
9.	B.	P. and F.	0	10	8,800	31	Pilot on one train overlooked the schedule of other train.
10.	R.	F. and F.	0	0	10,829	28	Leading train, entering side track, slightly delayed; following train not under proper control.
11.	M.	F. and F.	0	1	11,265	63	Collision at crossing of two railroads; air brakes inoperative; had not been tested at beginning of trip. Engineman negligent in not calling for use of hand brakes.
12.	B.	F. and F.	1	18	11,800	51	Entering side track at meeting point; overran switch and out on to main track.
13.	B.	F. and F.	3	13	12,000	17	Conductor and engineman of mixed train (1:30 a.m.) disregarded order to wait for opposing train; engineman was killed.
14.	R.	F. and F.	1	0	13,000	3	Runaway on long descending grade. Air brakes failed presumably because of closing of train-pipe cock in front part of train from some cause unknown. Conductor and flagman in caboose, men of brief experience, did not respond to whistle signal and did not apply air brakes.
15.	B.	F. and F.	0	3	15,000	33	Engineman started from station without signal from conductor. Conductor had delivered certain despatcher's orders to engineman, but afterwards went back and received additional orders, of which he did not advise engineman.
16.	R.	P. and P.	3	21	16,320	1	Approached station (3 a.m.) at uncontrollable speed.
17.	B.	P. and F.	30	64	17,581	13	Men in charge of freight neglected to observe signals on passing passenger trains. (See note in text below.)
18.	B.	F. and F.	0	4	17,600	36	Agent, 2½ months' experience, failed to deliver despatcher's order.
19.	M.	P. and P.	0	13	19,000	60	Eastbound ran through crossover and into side of westbound train. Interlocking connections had failed and switch had to be spiked; repairman by mistake spiked it in the wrong position. Personal injuries slight.
20.	B.	P. and F.	1	11	22,045	11	Conductor and engineman of freight forgot order to meet passenger train.
21.	R.	P. and F.	1	13	30,350	25	Freight not properly protected at rear by flag. Conductor, engineman, and flagman on duty 18 hours. Torpedoes had been used up; flagman neglected to replenish; had difficulty in lighting fusee.
22.	B.	P. and F.	10	31	34,200	32	Operator recopying despatcher's order made it read 1 hour 50 minutes instead of 1 hour 30 minutes. According to rule should have traced second copy from first.
23.	B.	P. and P.	8	25	36,300	48	Occurred 3 a. m. Operator (experienced) failed to deliver meeting order: evidently acknowledged the order to despatcher without setting his signal in the stop position. Six cars destroyed by fire.
24.	R.	P. and F.	0	2	37,900	2	Misunderstanding between block-signal operators.
Total, collisions			69	286	$349,860		

DERAILMENTS.

1.	D.	F.	2	2	$4,000	70	Train thrown off track by derailing switch at crossing, 4 a.m.: operator changed signal after train was close to crossing, evidently thinking train was on another (parallel) track. Operator's experience at this place, 3 days; elsewhere, 6 months.
2.	D.	F.	0	1	5,400	71	At derailing switch, 3 a.m.; engineman and brakeman asleep on engine.
3.	D.	P.	1	43	7,125	42	Very high speed on curve of 10°; elevation of outer rail, 4 5/16 ins.; weight of engine, 197,820 lbs. Engineman, who was killed, had satisfactory record up to the beginning of this trip. Injuries to passengers reported "not serious."
4.	D.	P.	1	7	10,200	22	Burning trestle, 6 a. m.
5.	D.	P.	0	45	10,913	65	Broken rail.
6.	D.	F.	0	0	11,150	43	Unknown.
7.	D.	P.	0	6	15,000	41	Broken wheel; personal injuries slight.
8.	D.	F.	0	0	18,900	40	Drawbar broke and fell to the track.
9.	D.	P.	1	8	25,000	67	Breakage of cast-iron wheel of baggage car; speed 50 miles an hour; three cars destroyed by fire.
Total derailments...			5	112	$107,688		
Total, col. & derail.			74	398	$457,548		

*Five of the principal accidents in this bulletin may be identified by reference to the *Railroad Gazette* accident records as follows:

Collision.		Killed.	Inj'd.
No. 17. Warrensburg, Mo.....Oct. 10		30	64
No. 19. West Phila., Pa.....Dec. 19		0	13
No. 22. Azusa, Wyo.....Nov. 12		10	31
No. 23. Maud, Ill.....Dec. 25		8	25
No. 3.† St. Louis, Mo. .....Nov. 13		1	43

†Derailment.

Accidents on English Electric Railways.

The risk of electric shock from live conductor rails is continuously receiving attention in England. The latest official statement is to the effect that on the electrified lines of the Lancashire & Yorkshire and the North Eastern there have been since operation began in the early months of last year nine fatal and 22 non-fatal accidents through contact with the charged rail. Of these, eight of each class affected trespassers; one fatal and 11 non-fatal accidents befel employees of the railroad companies. It is only on these two lines that such accidents have been reported to the Board of Trade, though there are other lines which have recently been equipped with the third rail system in place of steam locomotion. The accidents of this character that have happened on the various deep-level tube lines in London have been very few. So far as non-fatal shocks are concerned, there has been no occasion for any record to be kept by the Board of Trade up

to the present time; and of fatal electric shocks there have been none.

Various recommendations have been made by the electrical and railroad experts of the board as to additional precautions for shock prevention, and these the companies have readily adopted. One measure has been to educate the staff in the proper treatment to be used in order to restore respiration in those suffering from electric shock. The Lancashire & Yorkshire has adopted another sort of precaution in a new type of unclimbable fence to keep trespassers off the third rail, and it is reported that the North Eastern is experimenting with a new kind of ballast on its electrified section which is to drain away moisture more readily than ordinary ballast, and also be better as a non-conductor, thus lessening the severity of the shock in case of accident.

Fig. 2—Ice Flanger in Operation; Boston & Maine.

A Novel Ice Flanger.

The accompanying illustrations show an ice flanger or cutter designed for removing ice from the tracks in the yards of the Boston & Maine Railroad. This company had experienced considerable delay and trouble owing to the ice in its yards and had to resort to the slow and expensive method of picking it out by hand. C. C. Battey, Supervisor of Bridges and Buildings, designed the device shown in the accompanying illustrations, and to prove its practicability attached it to an ordinary flat car. This experimental device has been in use during the past winter and has proved to be a great time and money saver, having removed the hardest of blue ice without difficulty. The construction of the device is shown in Fig. 1, which shows the cutters in the raised position. Fig. 2 shows the device in operation, and Fig. 3 shows the condition of the track after the machine has done its work. The results obtained have proved so satisfactory that the Boston & Maine is now working out plans for a complete ice cutter and flanger which is to be attached to a car designed especially for this purpose. The arrangement of the cutters is to be the same, but in addition a flanger will be attached which will clean out all of the ice loosened by the cutters. The cutters and flangers will be connected and will be raised and lowered by compressed air.

The railroads of Italy are just now the subject of violent attacks by the press because of the wretched service offered and the frequent accidents which have occurred recently. It is claimed that trains are being run uniformly behind time, arriving from one to three hours late because of the dilapidated condition of the motive power and track. One radical opponent of the railroads declares that $100,000,000 would be required to overhaul all of the lines and bring them up to modern standards.

Fig. 1—Showing Cutters in Raised Position.

Fig. 3—Showing Work Done by Ice Flanger.

The Valtellina Line and the Electrical Operation of Railroad Main Lines.*

BY THEODORE KÖHN.

(*Continued from page 186.*)

III.—CHOICE OF VOLTAGE IN THE WORKING CONDUCTOR.

In choosing the tension on the working conductor regard must also be had to the amount of current that can be taken off by the contact device. If d.c. is used any desired current may be taken off since the third rail permits the use of as many contacts as the train has axles.

When overhead conductors are used for supplying current it is to be borne in mind that the pressure which the trolley exerts on the wire from beneath must be less than the greatest load to be applied by the conductor, to avoid dangerous oscillations of the trolley-wire. Experience shows that the current that a trolley-wheel can take off amounts to 300 amperes; heavier currents give rise to sparking and rapid deterioration of wheels. At a maximum current of 300 amperes the power taken from the line amounts to about 500 h.p. for every 1,000 volts.

Since present-day railroading does not call for locomotives of more than 1,500 h.p. capacity, a tension of 3,000 volts on the line will meet the operating demands of modern trunk lines. This may therefore be taken as a limiting voltage. Consideration of the question of the possible raising of this limit of voltage brings up the attendant disadvantages. In the speed-trials on the Marienfeld-Zossen military road the line wires were supplied with current at 12,000 volts; this voltage was cut down by transformers to 435 volts on the experimental car of the Allgemeine Elek. Ges., and to 1,150 on that of Siemens & Halske, with 1,850 at starting, and the current fed

*Translated from the *Organ für die Fortschritte des Eisenbahnwesens*, November, 1904.

to the motors at this voltage. But this causes the cars to be increased in weight, and thus one of the chief advantages of electric operation is lost, since the weight of the transformer increases with the capacity of the electric locomotive or motor car, the weight of the transformer for a locomotive of 1,200 to 1,300 h.p. amounting to 15 tons.

To raise the line voltage in this fashion will not serve the purpose, and the practical limit of voltage must be regarded as that for which it is still possible to construct the motors and contacts with the reliability adequate to operative demands. This is easily practicable for present day operative conditions, as the motors and equipment can safely be constructed for the voltages demanded by cheapness of conductors and transformers and satisfactory working of the contact devices.

As to the element of danger involved in the use of high tension and that of reliability of operation the following experts of European reputation were invited to express an opinion on this point on the occasion of the authorization of the Burgdorf-Thun road to Brown, Boveri & Co., namely, Sylvanus P. Thompson, Prof. H. F. Weber and Gisbert Kapp. They gave their opinions independently and unanimously in favor of the use of high tension. The opinion of Weber shows by a series of tests that the electric current may on occasion be dangerous to life near 100 volts, while on the other hand a current at even 3,000 volts is not necessarily fatal, if the conditions are favorable; thus there is no basis for confining the voltage, on the score of safety, within certain limits. The three opinions agree in this: that by making the right provision, properly executed, both the passengers and the employees can be protected from the danger of high tension.

It is true that there are occasional phenomena which resemble the undemonstrable ways of lighting in their puzzling nature, as when the current takes its path through poor conditions in consequence of a failure of insulation, so that human beings may unexpectedly be shocked on touching non-conductors or objects apparently not at all connected with the live-wire, but are connected with the earth by only a low conductivity.

The motors and equipment, however, for the high tension current can be located in the cars without any danger to passengers or employees by arming the high tension conductors not only with an insulating coating, but also with a conducting, closed metallic sheath conductingly connected at several points with the trucks of the car, and hence with the rails and earth.

These safeguards must be applied to all metallic parts of the car, especially to the roof, the metal covering of which must also be in connection with the earth. This metal covering does not come into action until the insulation is injured; it serves in a sense as a lightning-protector, by which the current is brought to the underbody and so to earth. This conducting connection of the roof and all other metallic parts of the car with the wheels and rails provides perfect security for the people in the cars even in the event of the trolley wire breaking and falling on the car, for through these connections the damaged part is grounded, the nearest fuse melts and the injured section automatically becomes dead. Tests made by the commission detailed by the Italian government for examining all electrical devices, confirm this.

The high tension conductors are accessible to the attendants only when the trolley is down, and the car is without current.

Just as a short circuit occurs and the affected part is simply cut out because of the grounding of the roof when a wire breaks and falls on a car, so the same thing takes place if the broken wire falls on the rails. But danger can ensue if such a broken wire hits persons before touching the rails. The employees are given rules for such cases, unauthorized persons are in any event forbidden to trespass, and in locations where high-tension lines are carried along the highways they are naturally avoided. At crossings the imperiling of individuals may be considered to be prevented by the guard-wires already known in street railway practice, which automatically make a short circuit when a wire breaks.

At the stations the whole conducting system is constantly without current. It is not thrown in until immediately before the arrival of a train, and is cut out at once on its coming to rest. The conductors at stations remain dead until the train is about to leave, and are then switched in only until the train has left the station. In this way such a degree of safety is secured that if the exceptional case should occur and a wire break despite continuous inspection and maintenance, this can only be dangerous at a time when traffic within the region of that con-

Fig. 1—Milan-Varese-Porto Ceresio Line.

ductor is prohibited anyhow because of the moving train.

The question now arises to what limits is the raising of the voltage justified?

As has been indicated somewhat in detail above, the reduction of conductor section and other savings secured by raising the voltage are limited by certain governmental and constructional conditions. A certain limit has also to be put on the distance between transformer stations, else the independent sections of line will become too long, and in case of needed repairs to the conductors the parts to be thrown out of use would be too long.

The feeder system to the transformer stations is not subject to mechanical wear and deterioration and hence does not here enter into consideration.

Of special value for trunk line operation is the property of polyphase motors that the raising of their r.p.m. by an external force causes them to send current into the line. If a train is descending a grade and its speed increases beyond that corresponding to the usual r.p.m., the train is braked by the motors, but the power consumed in braking is not converted into heat; instead it flows back into the line in the form of electric current. In this way the work required for the ascent is largely recovered on the descent of a grade, and the operative costs of trunk lines with heavy grades are considerably reduced. Thus it is not so very important in projecting new lines to have the grades as slight as possible, so long as the down grades can be used in overcoming the up-grades. Thereby the cost of the track can also be diminished.

The "cascade" connection makes possible the reduction of the usual speed by half, so that the train can travel at two different speeds, where the change from the higher to the lower speed again sends into the line as current an amount of energy corresponding to the difference of the two, and the speed can be halved without braking by merely changing the motor connections.

The current thus recovered amounts theoretically to 75 per cent. of the work that was needed to get the train up to the usual speed. From this is to be deducted a loss of energy dependent upon the efficiency of the motors and line. This property of polyphase motors and this mode of connection will be applied with advantage on those lines on which trains frequently have to stop and start, that is, on urban lines. To what extent this recovery of power will be realized must be determined by experience; that it is thoretically possible is shown also by Prof. W. Kübler (Dresden) in his writings on "The Three-phase Motor as a Railway Motor, 1903."

The use of high tension offers the added advantage that the small currents which it involves make it possible to so interlock the various sections of conductor with the track-switching apparatus and block signals that several hundred meters of line at each end of the stations are controlled by them and can only be connected in circuit when the track switches are in the proper position, thus rendering complete the safety of the yards at stations.

IV.—Influence of Three-phase Operation and of Three-phase-d.c. Operation on Costs of Installation and Maintenance of Power House and Substations.

Director Köhn has expressed himself as follows on this comparison, taking as a basis the example above assumed by Director Cserháti and Vice-Director u Kandó on a 15 km. line.

At 90 per cent. efficiency of motors and 10 per cent. transmission loss the work required at the switchboard amounts to 500,000 watts, which in case of d.c., at a voltage of 700 volts at the most, corresponds to 700 amperes. For a train running at 70 km. and a starting train for which only a double demand of current will be assumed, there will then be required 2,100 amp. When two are starting simultaneously this rises to 2,800 amp. The mean current, including the starting, will hardly exceed 35 watt-hours per ton-km. If then trains of 300 tons run at 1.5 hourly intervals in both directions the mean consumption will be

$$\frac{2 \times 300 \times 15}{1.5} \times 35 = 210{,}000 \text{ watts};$$

at 700 volts the mean load on the station is therefore 300 amp.; the maximum current-demand is thus seven to nine times as great as the mean.

As the converters for three-phase-d.c. require constant attendance while running, larger buildings are needed for them than for the three-phase step-down transformers, which can be thrown in or out by the line-guards. Thus not only will the cost of installation of the three-phase-d.c. converters come considerably higher than that of the three-phase step-downs, but also the cost of attendance in operation. The up-keep is additionally increased by the maintenance and renewal of the movable parts of the rotaries, whereas the step-down three-phase transformer, consisting of stationary parts only, can be built so strong as to be almost indestructible.

Finally in favor of three-phase is the cir-

cumstance that by paralleling transformer stations, as has been done on the Valtellina Line, an equalizing of load is made possible to an extent not attainable with d.c.

The Mediterranean Company first caused the line Milan-Varese-Porto Ceresio on Lake Lugano to be electrically equipped by the French Thomson-Houston Co., and opened the section to Varese for public travel on Oct. 20, 1901. This was followed by the adjoining sections from Varese to Porto Ceresio, 1902, and from Gallarate to Arona and Laveno on Lake Lugano.

The whole length of these lines (Fig. 1) amounts to 130 km. They are divided into the following divisions:

Division	Length, km.	No. of tracks.	Max. grade, pr mille.	Least rad. of curve, m.
Milan—Rho	14	2	4	2,000
Rho—Gallarate ..	27	2	6	800
Gallarate—Varese.	18	1	10	500
Varese—P. Ceresio	14	1	20	300
Gallarate—Arona..	26	1	10	350
Gallarate—Laveno.	31	1	8	600

High-voltage three-phase at 13,000 volts is generated in the steam power station at Tornavento on the left bank of the Tessin. Near the steam station there is a water power which is later to be used for operative purposes. The three-phase at 13,000 volts is transmitted to the four transformer stations by two separate feeder lines, shown dotted in the illustration, Fig. 1. The one runs out to Parabiago, 19 km. from Tornavento, and continues to Musocco, the other to Gallarate, 11 km. from Tornavento, and thence by way of Gazzada to Bisuschio on the line Parese-Porto Ceresio.

The four substations are located in Musocco, Parabiago, Gallarate and Gazzada. Their distances apart are:

Milan to Musocco	6 km.
Musocco to Parabiago	17 "
Parabiago to Gallarate	17 "
Gallarate to Gazzada	14 "
Gazzada to Varese	5 "

Stationary transformers reduce the voltage from 13,000 to 420, and are connected with rotary converters which deliver d.c. at 650 volts with which the line conductor is fed. The line is fitted with a third rail, the car equipment corresponding; it coincides with the line and car equipment in use for years on the Liverpool elevated, the Chicago-Metropolitan South Side Elevated, and various other American roads, so that it was to be foreseen that it would prove satisfactory from a technical standpoint on this line. The more rapid and frequent electrical service is said to have had a most marked effect in increasing the traffic and income.

Which mode of electrical operation is the more advantageous experience will decide. Certain it is that success has been attained in electrically operating main lines of the usual construction for passenger and freight traffic with reliability and that a marked step in advance has been made in the history of the new railroading.

On the basis of this general fact, and of the three-phase electric operation used on the Valtellina, of which a more detailed description follows, Director Köhn makes a comparison between operation by steam locomotives and by electric locomotives.

V.—COMPARISON BETWEEN STEAM AND ELECTRIC LOCOMOTIVES, ACCORDING TO KÖHN.

Where coal is dear and water power cheap and in sufficient abundance, the latter will in general be more advantageous for power. For this comparison therefore only the generation of power by means of steam will be considered.

(a.) Influence of the Firing of Boilers.

The evaporation ratio of a locomotive boiler is about 6, that of a stationary boiler at least 7.5; under equal conditions the latter is at least 25 per cent. higher because in case of the locomotive boiler some 200 to 500 kg. of coal can be burned per hour per square meter of grate area, against 50 to 100 kg. in the case of the stationary boiler. Besides, a very strong draught is requisite so that the smoke gases escape at high temperature.

From this Köhn determines that the annual savings to be made by electric operation in the expense for coal, coke and press coal would amount to 23,716,000 m., based on the data in the "Statistics of the Railroads of Germany" for the fiscal year 1900.

(b.) Maintenance and "Firing-up."

Even more important than the saving of coal is the difference between the maintenance of locomotive boilers, with the unavoidable cost of preparing locomotives driven by steam, and the stationary boilers. A locomotive boiler remains in service only a short time, and the wear particularly on the firebox is very severe because of the frequent heating and cooling. Besides, the water at the tank-stations is often poorly adapted to the locomotives, and purifying plants have been installed in but a few places; in particular cases resort has even been had to spare boilers kept on hand so as not to keep too long out of commission the other sound parts of the locomotive while the boilers are being put into condition.

Maintenance of the stationary boilers is much easier. They are kept in continuous service longer; when this is interrupted they are cooled off gradually; besides, stationary boilers can be supplied with good feed-water by the usual purifying plants.

From the German railroad statistics for the fiscal year of 1900 it appears that the 19,065 locomotives in use covered 760.51 million locomotive-km., of which only 511.91 million were useful. Thus each locomotive annually covered on the average 40,000 locomotive-km. and 26,800 useful (or service) km. Since it has been found from tests on electric street railways that motor cars, including reserve units, average annually 40,000 service km. at a mean speed of 12 km. per hour, it may be assumed that at mean speed of 25 km. per hour an electric locomotive or motor car will cover at least 80,000 service kilometers, the more so since the electric locomotive is ready for use at any moment, and is a simpler machine than the steam locomotive, not requiring frequent repairs. From these figures it appears that half the steam locomotives are out of use through being either prepared for their runs, or undergoing repairs. So if electric locomotives were used we could get along with half the number, requiring for the German railroads only 9,534 electric locomotives instead of 19,069. Since statistics show that a locomotive annually entails mean maintenance costs of 4,294 marks ($1,017) the taking away of 9,534 steam locomotives would mean a saving of 42,000,000 marks (over $10,000,000).

(c.) Tender.

The electric locomotive does away with the dead weight of the coal and water reservoir and tender, so that the dead weight to be dragged along is decreased by 30 tons for each train. This may be replaced with a useful load without additional cost. Statistics show the useful load per car axle to be 2.76 tons. Taking the dead load as seven tons per axle, the total load per axle becomes 9.76 tons. Thus for a saving of 30 tons of tender, 3.07 loaded freight-car axles may be moved, or 3.07 x 2.76 = 8.47 useful tons. As the German locomotives cover 511.91 million service kilometers, as stated above, these 8.47 useful tons give 511.91 x 8.47 = 4345.877 million useful ton-kilometers and at 3.54 pf. per useful ton-kilometer yield a net increase of 15,350,000 marks (roughly speaking $4,000,000).

(d.) Steam Consumption.

Under favorable conditions the best express compound locomotive consumes 8 to 9 kg. of steam per h.p. hour—stationary compound engines of more than 2,000 h.p. running condensing and with superheated steam, 4½ to 5½ kg. at full load.

Now even if we include the losses occurring in the steam engine itself, in the generators, feed and supply wires, transformers, and motors of the electric locomotive, or motor car, these will amount at most to 30 or 40 per cent., so that the steam used per horse-power hour does not exceed 8 to 9 kg. in this case either. The locomotives that run more slowly, and especially the big freight locomotives require 1½ to 2 times as much steam because of the later cut off. The speed of an electric locomotive does not of itself affect the efficiency, so that these locomotives work just as advantageously for freight trains as for passenger, provided that they are proportioned for the proper speeds.

(e.) The Locomotive.

Even aside from the weight of the tender, the electric locomotive can be considerably lighter for the same service because it is laden only with the motors and the electric equipment, and each of its axles may be driven directly. The capacity of a steam locomotive is further limited by the quantity of steam that can be generated in the boiler in unit time. Hence a locomotive of great capacity requires a boiler with large grate and heating surface, and this brings with it great weight, which usually exceeds that needed for adhesion for the necessary drawbar pull, so that all express and passenger locomotives have pony axles for the excess weight. But the electric locomotive is also superior to the steam in that with the same adhesion it can exert almost twice the pull, for while only 16 per cent. of the adhesive weight serves for drawbar pull in case of the steam locomotive, this figure rises to 22-30 per cent. in the case of the electric, as tests on electrically operated roads in America and Europe have shown. The reason for this is partly that the peripheral-force at drivers of the electric locomotive is steady, partly perhaps that the passage of current from wheel to rail causes heating and drying of both. Even more to the advantage of the electric locomotive as regards capacity is the fact that the resistance of a steam locomotive to its own motion, per ton, is more than twice as great as that of a car because of the friction of its parts, and especially because of the necessity of coupling of the axles. On the level the resistance of the cars is

$$W_w = 1.5 + 0.001\ V^2.$$

That of the locomotives is

$$W_v = 4\sqrt{a} + 0.002\ V^2.$$

where a is the number of connected axles, and v = speed in km. per hour. As the axles of the electric locomotive have only two more bearings and in addition regard is to be had only for the slight friction of the flexible connection which joins the rotating part of the motor to the wheel, the resistance of an electric locomotive will not greatly exceed that of a passenger car with the same number of axles. According to the reports of Leitzmann, the steam consumption per h.p. hour at the drawbar of a four-cylinder locomotive is two to three times as great as that per h.p. hour indicated. The difference is used up in the work of propelling the weight of locomotive and tender, and in friction of the parts of the machine.

Each locomotive entails annually an expenditure of 4,296 marks for 26,800 traffic (or service) kilometers, or about 16 pf. per locomotive per useful kilometer. The saving in steam consumption and capacity of

locomotives secured as shown in *d* and *e* may without exaggeration be taken as 15 per cent., or 2½ pf. per useful kilometer, which with 511.91 million locomotive-useful-kilometers amounts to 12,798,000 marks.

(*f.*) *Saving in Employees.*

Every steam locomotive requires at least two people. Because of the demands on his intelligence a relatively higher wage must be allowed for the engine driver than for the motorman of an electric locomotive, the simplicity of which makes the more highly trained engineers dispensable on the Valtellina Road. Moreover, the electric locomotives require but one engineer, since the train can in case of need be stopped from the station by cutting off power on the line, and can also readily be put under the supervision and charge of the conductor trained as a motorman.

Hence there could annually be saved 11,400,000 m. wages on the roads of the German empire, 9,534 electric locomotives with 1,200 m. on each.

(*g.*) *Summary of a to f.*

The yearly savings, deduced as above, amount together to 105,264,000 m., which is 5 per cent. of 1,750,000,000 m., equivalent for 49,930 km. at a cost of 35,500 m/km. for installing electric traction. Added to this would be the value of the locomotives, according to statistics of the railroads of Germany 43,500 m. per locomotive. Since half of the existing supply could be disposed of there could be expected a fund of 41,720,000 m. taking a selling price per locomotive of only 4,350 m., which would make 8,300 m. per km. of line. Hence there would be available 43,800 m/km. for changing over the German railroads to electric operation. Hence there would annually be saved 11,400,000 marks wages on the roads of the German Empire.

On the Thur-Burgdorf line, 40 km. long, the costs were:

Feeders	112,000 m.
Transformers	128,000 "
Trolley wire	280,000 "
Elec. equipment of 6 motor cars, 2 locomotive, light and heat of trailers	188,000 "
Elec. station and workshop lighting	16,000 "
Spare parts	24,000 "
Total	748,000 m.
Per km. of line	18,700 "

Add the share of cost of power-station at Spiez with about 2,000 k.w. at 240 m., or 480,000 m., or per kilometer of line, is 12,000 m., making together per kilometer, 30,700 m.

The 106 m. lines, Lecco-Colico-Chiavenna and Collico Sondrio cost per kilometer 40,500 m., excluding the hydraulic works and assuming steam power.

It may well be assumed that the conversion to electric, of all German roads, with use of three-phase will not come higher than this, even though some parts may cost 10 or 20 times as much. But several advantages and the possibility of further economies is still to be considered.

(*h.*) *Up-keep of Cars.*

From the smoke both the inside and outside of cars suffer, entailing high charges for cleaning and maintenance. The rare application of brakes, and the gentle start of the electric locomotive spare all parts of the car, but especially the brake-shoes and wheel-tires.

(*i.*) *Maintenance of Way.*

For the same capacity, the electric locomotive can be lighter than the steam locomotive, and as there is less of a limit on the number of driving axles in the case of the electric locomotive the wheel pressure may be kept lower than on the steam engine; the injurious movements and the shock at starting vanish almost completely in the case of the electric locomotive. The conditions are therefore better for the track.

(*k.*) *Other Differences.*

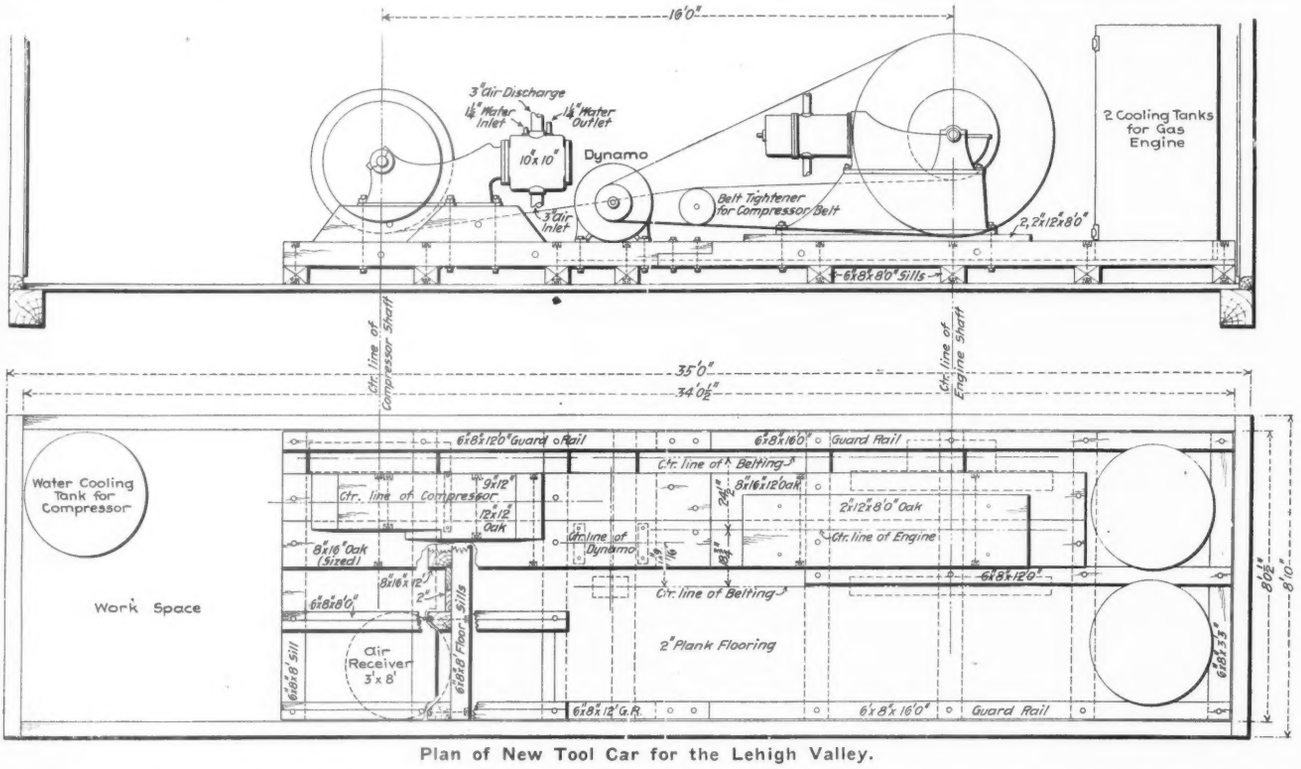
Attention has been called to the recovery of energy on down grades, to the great reliability of operation with electric power, to the avoidance of the smoke nuisance and the adaptability of electric operation to fluctuating demands. There may also be mentioned the installing of electric lighting, heating and ventilation of cars, stations and line, so that under some circumstances special power plants for stations may be saved.

(To be continued.)

A suburban train on the London, Brighton & South Coast is being lighted throughout with incandescent gas-burners using mantles of the inverted type and Pintsch gas. The burners are of 25 candle power each as against eight candle power for the fish-tail burners ordinarily used, and the consumption of gas is only .6 cu. ft. per hour as against 1 cu. ft. The only change necessary to apply the incandescent burners is to change the pressure reducing valve so as to give a pressure of 8 in. of water instead of 1 in. which is used with the ordinary burner.

New Tool Car for the Lehigh Valley.

The Lehigh Valley has recently fitted up an interesting new tool car, a plan of which is shown herewith. It is a portable shop and power plant mounted on an ordinary 34-ft. box car taken from service and contains a 25-h.p. gasolene engine, one flywheel of which is belted to a 10-in. x 10-in. air compressor and the other to a 12-kw. dynamo. The three machines are bolted to two 8-in. x 16-in. oak timbers which are laid flat and are bolted in turn to 6-in. x 8-in. oak sills resting on the car floor. The compressor delivers air at 100 lbs. pressure and the dynamo delivers current at 225 volts. There is space at one end of the car in which to work, and, in addition to the equipment already described, there are the switchboard and instruments for the dynamo, 100, 16-c.p. incandescent lamps, a receiver for the compressor and a sand-blast apparatus; also six pneumatic riveters and three drills, two forges and a cold saw. There is also, of course, the necessary hose for the portable pneumatic tools and the wire for the portable incandescent lamps.



Plan of New Tool Car for the Lehigh Valley.

The car is expected to prove especially useful in field work, being available both night and day by reason of its electric plant. This feature and its tool equipment as well will make it valuable at wrecks. The sand-blast apparatus will be used for cleaning the steel structures of the railroad. The car was planned and the equipment installed by the Otto Gas Engine Works, Chicago, Mr. T. W. Snow, General Manager.

The Canals of England.

During the past few months there has been a considerable growth of the long-standing agitation to revive the English canal systems. The demand for improvement which is now being made includes a proposition for the taking over of the present boat and barge canals by the Government with a view to their being worked in the public interest, giving continuous and uniform facilities for through traffic, perhaps under local initiative and control. It is contended by some that it is quite useless to introduce a bill on such lines as we have indicated, as it does not stand the least chance of being carried in the near future. One feature of the present movement is the attention which is being devoted to the prospects of electrical operation, and the experience of Continental and American systems thus worked is being quoted in support of revivification by electrification. Beyond this, there is a good deal being said regarding a scheme for draining some of the canals in the London area and using them for electric railway routes. Whether this scheme will ever get beyond the paper stage it is unsafe to predict just now, but there seems to be more immediate prospect of the use of electric traction for barge operation, especially in the London area. At any rate the metropolitan electric power supply companies can see in the canals a possible very acceptable customer before very long, for they are at this moment before Parliament with applications for powers enabling them to sell electrical energy in bulk to them. The position which has given rise to the applications is a curious one. The electric supply companies have power to sell electricity for use within their own scheduled Parliamentary area, but if the canal boat or railway train gets outside the particular area in which it starts to take supply, the supply company is acting beyond the powers that Parliament has conferred upon it. The London companies are seeking powers to alter this somewhat absurd position of affairs, and if they get their way it will be legal for any railroad or canal authority to buy electricity in one area and distribute and consume it on its trains or barges wherever it may find it convenient to do so.

On March 6 the Society of Engineers in London met to consider an interesting paper by Mr. Benjamin H. Thwaite entitled "The Transport Possibilities of Our Inland Navigable Waterways." The preliminary parts of the paper were historical and brought out the indebtedness of British manufacturing industries to ancestors who 800 or 900 years ago undertook the pioneering work in connection with canal construction. "Engineering science," said Mr. Thwaite, "is not without its obligation to the old canal constructors, who provided much of the experience in excavation, embankment formation, puddle work, retaining wall and bridge construction, warehouse building and sluice making, which was available for the early railroad builders."

After a brief resumé of canal development along the centuries, Mr. Thwaite turned attention to the year 1821, when "the shadow of the coming rival—the railroad—had already fallen upon canals. The "railroad mania," we are told, killed interest in navigable waterways, and the rights of the acts relating to their construction and maintenance were ignored. Then followed the railroad companies' policy of absorption "as a preliminary to the destruction or suppression of their traffic competitor as far as practicable." Some of the important railroads, however, of recent years have shown a tendency to relinquish their canal properties. The author of the paper went on to advocate a policy of government confiscation of canals which have been neglected or otherwise made inefficient, allowing compensation only on the basis of the traffic carried by the canals, and the profit earned by them. Figures were given to show the comparative revenues of independent canals and railroad-controlled systems with a view to illustrating the extent of the "railroad handicap." The annual traffic over the independent canal per mile was given as 12,000 tons, and that over the rail-controlled as 5,000 tons.

The difficulties confronting the transformation of canals into railroads were mentioned, an alternative suggestion being their transformation into motor or car-ways.

A canal trust has been formed at the instance of the Worcester Chamber of Commerce for restoration and improvement of a wide group of canals which were once controlled by the Great Western Railway, but are now relinquished to the Gloucester and other companies.

In the course of an examination into methods of canal boat traction, a description was given of the Thwaite-Cawley "electric horse" system of operation which has been tried on at least one English canal system during recent years, and a Ganz modification of which has been used in Germany. The motor, or "electric horse" as it is called, travels on light superposed steel rails carried by vertical standards erected at intervals along the extreme boundary of the canal towpath. The wheels of this electric horse grip on the steel rail providing the adhesion necessary to secure the haulage of the boat, the grip of the motor being directly proportional to the tension on the tow ropes. One rail permits the electric horse to draw its boat in one direction, and another, super-elevated, permits its electric horse, and without fear of entanglements of the two ropes, to draw its burden in the contrary direction. The motor can be stopped or started from the boat. For trunk canals, gas power generating stations would be located every 20 miles, for electrical transmission at high pressure and transformation to lower pressures for distribution. Locks, gates and sluices could all be electrically operated, and electric capstans would provide the necessary elasticity to the haulage system.

An estimate has been prepared by Mr. Thwaite of the cost of nationalizing, perfecting and electrifying the canal system of the United Kingdom. On the assumption that 3,500 miles can be purchased at two-thirds of their cost, he puts the total outlay at $100,000,000.

Why Private Car Lines Were Overlooked in the Esch-Townsend Bill.

BY J. W. MIDGLEY.

The following is a liberal extract from Mr. Midgley's circular letter No. 38, just issued:

The halt in railroad legislation at Washington affords opportunity to survey the situation and indicate what should be done. I am not disposed to dwell upon the decision of the court of last resort against the packers, or to exult over the predicament in which those hitherto invulnerable parties find themselves. The accused are threatened with trial, and as simple justice is all they have pleaded for, their prayer is likely to be granted. One thing is certain—that they have been sadly humiliated, and that none is now so poor as to need to do them reverence.

The reason why the correction of private car abuses was omitted from the Esch-Townsend bill was not generally known when Circular Letter No. 37 was written. I had urged the President to recommend that private car lines be placed under control of the Interstate Commerce Commission to the same extent that railroad companies are presumed to be. This was because these lines had successfully resisted the authority described. It now appears that interested shippers opposed such course. The president of the National League of Commission Merchants writes that his people do not wish to have private car lines classed as common carriers. Speaking for the Car Lines Committee of the League, he thus puts the matter:

Our position is this: That the railroad company should be obliged to furnish all the equipment needed, and perform all the service necessary to safely transport any and all commodities that may be tendered them; and that it shall be the duty of the railroads to publish a tariff rate—the same to be filed with the Interstate Commission—which shall include all service rendered. They may get their equipment of refrigerator cars from whatever source they may see fit—whether it be from a connecting line, a private car line, a holding company, a manufacturing company, or from whatever source they deem fit—but the published tariff rate shall include every element of expense that enters into the transportation of the commodity. In that way we would have control of the refrigerator rate through the Interstate Commerce Commission. We are not in favor of making a common carrier of the private car lines, provided that could legally be done.

Similar views were expressed by witnesses before the House Committee on Interstate Commerce at Washington, and in support thereof charges were cited for the transportation of peaches for long distances in private cars from $75 to $100 per car in excess of those demanded for identical services rendered by railroad companies in their own cars. This, it was claimed, was owing to exclusive contracts of railroads with private car lines.

Naturally, the publicity given to flagrant instances evoked a storm of indignation, and railroad managers hastened to disclaim responsibility therefor. One gentleman, who is foremost in financial and railroad circles, in a letter to the undersigned, thus aptly voiced the prevailing sentiment:

The showing made in the fruit car case has attracted very general attention, and I think that people generally do not believe that railroads are justified in making arrangements that admit of such abuses. It is these showings that have given edge to the demand for further legislation, which is likely to trouble the roads before it is through with.

The continuance, unchecked, of the conditions above mentioned, and others which have been exposed certainly "will trouble the roads" unless energetic measures be taken to correct them. Forbearance is a characteristic public virtue, but in this instance it has been exhausted, and although the adoption by Congress of a mild remedy was frustrated, it was merely postponed. The desire to escape the odium which attached to notorious practices of car lines impelled railroads to leave the former to their fate. In that way the efforts of shippers to defeat the inclusion of private car lines under jurisdiction of the Commission succeeded.

It was the relentless exposure of the unjust exaction of private cars that led to the persistent demand for repressive railroad legislation. To recall attention to the first cause, suggestions were made which, had they been put in effect, would have eliminated objectionable car lines. As the day of reckoning has only been delayed, I will quote one plan not heretofore published that was put forward by an officer of high degree. He thought if Congress could be induced, during its closing days, to pass the measure in lieu of the pending House bill, it would remove the entire subject from discussion. His measure would have provided:

That it shall be illegal for any private car company to charge or receive from a shipper any charge for the use of said cars, or for icing or other care of the contents of these cars during transportation;

That the railroad companies must name rates and publish tariffs covering the transportation of commodities in so-called private or special cars, which rates shall cover icing, car rental, or any other charges which may be imposed for the use of such cars, or for the care of freight transported therein;

That it shall be illegal for any railroad company to pay, or any private car company to receive, for rental of private cars, a higher rate than railroad companies pay each other for use of cars of similar class in the ordinary interchange of business.

The foregoing was received about ten days before the close of the session. Obviously, it was too late for action, it being understood that appropriation bills have the right of way and that no new measure can be introduced during the last two weeks of Congress.

It is important to note the direction in which the movement against private car lines is tending. Shippers and railroad men desire to have them eliminated as agencies of interstate commerce, and are likewise opposed to their usurping the functions of common carriers while repudiating the responsibilities that belong to the latter.

I was, therefore, warranted in saying, in a letter addressed, March 15, to certain executive officers, that:

Common carriers will be required to provide the equipment necessary to handle tributary traffic, and the charges for all services—transportation, preservation or care of commodities—will have to be comprised in the tariffs of railroad companies. That would leave the latter free to procure special cars in such way as would be expedient—acquire the

same, or arrange for them through an equipment company. Shippers are resolved not to be obliged to depend upon private car lines, even though the latter should be constituted common carriers, but to limit their dealings to railroads.

I am satisfied that the result will be as stated, and having, despite obstacles such as never before confronted any railroad reform, carried this movement to the turning point, it being in competent hands, and the outcome certain, it can be safely left there; yet, if desired, the undersigned will be ready to assist in the final determination. When that time comes—as it surely will early next year—along with others whose support has been assured, we shall be prepared to organize an equipment company to take over at a fair appraisal, in the interest of assenting railroads, such private cars as may be desirable.

Meanwhile, alarm was felt, owing to the increasing determination to confer upon the Interstate Commerce Commission authority to fix rates on interstate traffic. For example, Mr. Samuel Spencer, president of the Southern Railway, who appeared before the committee of Congress late last January, after referring to the conservative character of a speech made by President Roosevelt, in Philadelphia, on the subject of the correction of railroad evils, said:

I desire to add emphatically in behalf of a large proportion of the railroads of this country—a much larger proportion than I have any direct authority to speak for, but I say it safely—that there is no difference of opinion between the railroads, the country, Congress, and the President on the subject that rebates are wrong and that they must be stopped; that secret and discriminatory devices of all kinds, direct or indirect, must meet the same fate; and, to use the President's own expression, "the highways of transportation must be kept open to all upon equal terms." On that basis the railroad companies are ready and anxious to aid and co-operate.

As before stated, my belief was that the law as it stands is adequate to enable the Commission to suppress private car abuses, and I had reason to think that if the Commission had ruled that the allowances to private car lines were excessive, and that, as such, they were devices forbidden by law, and had ordered reductions, these would have been made effective by interested common carriers. It would, therefore, seem that a good opportunity to have rendered excellent service was neglected. Railroad companies, although prodded to take the initiative, feared to do so lest powerful shippers should punish them with a loss of traffic; whereas, if a standard of compensation had been established in the way described it could have been cited as an authority which, under the circumstances, none would have presumed to ignore.

On the 2d of March the Senate adopted the Kean resolution (previously printed in the *Railroad Gazette*), providing that an investigation to be undertaken by the Committee on Interstate Commerce or any sub-committee thereof, during the Congressional recess, should include violations of the anti-rebate law and private car and terminal railroad abuses.

The following quotation will serve as an illustration of the difficulty of securing direct testimony on the private car abuses:

Geo. B. Robbins, President of the Armour Car Lines, said to the sub-committee of the House Committee on Interstate and Foreign Commerce that the Armour Car Lines was a separate organization from the Armour Packing Company, although both were owned by practically the same people. He refused to state what was earned on the capital of the company. The daily average of miles a car will make, Mr. Robbins refused to state for publication. He said that should it appear that the company was earning more than 6 or 8 per cent. on its capitalization it might be used by the enemies of the company.

Information as to the earnings of private car lines, however, is not dependent upon admissions of reluctant witnesses. Commissioner Garfield, in a report to Congress, March 3, relative to the beef industry, referred to private cars and their operations as follows:

The profit on private refrigerator cars is that derived from the mileage paid by the railroads, which, roughly speaking, averages slightly more than three-fourths of a cent per mile for every mile traveled by refrigerator cars, whether loaded or empty. The average distance to which beef is transported from the packing house before consumption does not exceed 800 miles. The gross mileage received by the owner of the refrigerator car would therefore be, roughly, $12 per round trip. The conclusions in regard to the operations of private car lines are approximate. The Bureau arrives at an average cost for a refrigerator car of $1,000, an average yearly cost of maintenance of $115 per car, and a net profit from the mileage alone of from 14 per cent. to about 17 per cent. A statement submitted by one company—the Cudahy Packing Company—shows an actual net profit on the original investment in its cars of 22 per cent. in 1902, of 20 per cent. in 1903, and of 17.7 per cent. in 1904. These profits are entirely derived from the mileage allowed owners of private cars by railroad companies.

As railroad companies, under the per diem code, are restricted to 20 cents per car per day when their equipment is interchanged, and many of them control or operate large numbers of refrigerator cars which cost fully as much as those owned by packers, would it be possible to justify (before a competent committee or to investors) the payment of three times as much for the use of private cars as is specified for the exchange of the same class of railroad cars?

Those who keep in touch with public sentiment need not be reminded of the gravity of the political situation so far as railroads are concerned; but there are some who have thought that, by discontinuing the agitation of private car abuses, the larger question of railroad legislation would also be dropped. This was a mistake, because, whether the aggressive work conducted by the undersigned the past two years be supported or neglected, the subject having been taken in hand vigorously by the President will not be allowed to fail. The Senate Committee, as before recited, must make a thorough and comprehensive investigation in order to evolve a bill or report, which has to be submitted within ten days of the opening of Congress. Furthermore, the testimony is to be distributed as rapidly as it can be printed, for the benefit of Senators who will, presumably, be at home. The said committee will meet in Washington April 17 ensuing.

President Mellen, of the New Haven System, made the following comment on this subject in an address delivered before the Committee on Railroads, of the Connecticut General Assembly:

If a railroad cannot handle itself without discrimination between persons and between places and treat all alike fairly, it is time for the public which created it to supervise and control it, when it is shown it cannot be trusted to control itself.

Do not make another blunder like the Interstate Commerce law and establish a tribunal that will be so anxious for more power it will neglect to use what it has.

The demand for a strict supervision of railroads in the interests of public welfare is the issue of the hour. It is right it should be so. There have grown up great abuses without doubt, and it is time they were laid bare and stopped. A railroad enjoys great privileges from the public. It performs a public service—it imposes a tax which should be alike to all who use it.

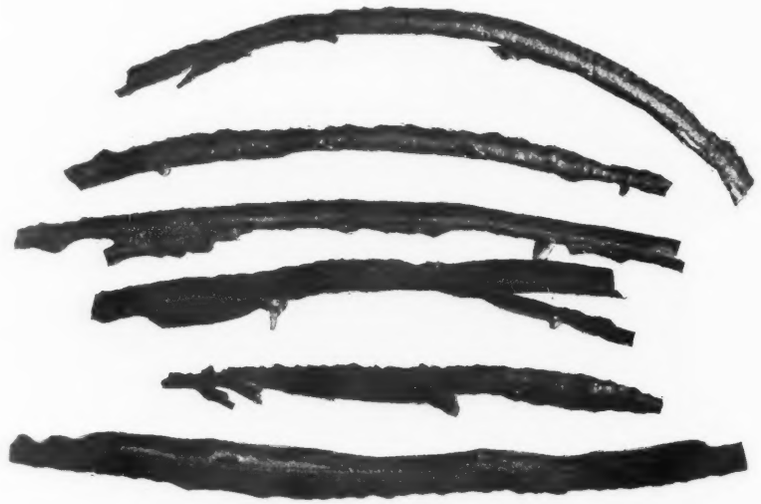
But it is not a project to be entered upon hastily. You must not make the cure worse than the disease; nor should those confessedly guilty be permitted to prescribe rules and regulations to be observed by those who have behaved themselves, if such there be. Here is not a case for the theorist or the crank, but for the man of affairs; the jurist of repute; the man who puts his citizenship above other considerations. Give it into such hands and give these men time.

It must have occurred to intelligent parties that if those who have sustained intimate relations with railroads for many years, and are therefore familiar with the manner in which business is transacted by the corporations, should give to those in authority the benefit of their varied experience, the demand for action would sweep away everything that interferes with the equal enjoyment by the public of the highways of commerce.

That gross and unjust practices have long attended the transportation of interstate traffic, and that legislation and restraints have thus far failed to correct them, every sincere and intelligent man must admit. That is a situation which, were it to be relentlessly exposed, would not be tolerated, especially when the power to correct the same lies with Congress, and the President has, in his message to that body, declared "they must be stopped." Why not recognize, then, that the time for amendment has come, and that an obstructive policy will not avail to avert what has surely become an irresistible demand for relief? In some form or another it will have to be conceded.

Shavings Cut from Rails by Wheel Flanges.

That long shavings can be cut from the head of the outer rail on a sharp curve by the wheel flanges of a switching engine and also by the wheel flanges of a slued truck under a heavily loaded car, seems new although it may not be new to some readers of this paper. A certain amount of rail wear on sharp curves under heavy traffic is always to be expected, but an example of cutting, not merely abrasion and wear, is unusual. Mr. Samuel Rockwell, Assistant Chief Engineer of the Lake Shore, has brought to our attention such an example. In the yard of the Lake Shore at Ashtabula Harbor, Ohio, is a 16 deg. curve which carries a heavy traffic of 100,000-lb. cars loaded with coal and iron ore, and most of the switching is done with six-wheel switching engines weighing 130,700 lbs., and having a wheel base of 11 ft. 3 in. These engines when passing around this curve cut long thin shavings from the inside of the head of the outer rail and soon wear it away until it has to be removed. The engines are all quite new and the tires are in good condition without sharp flanges. The accompanying illustration, from a photograph of a number of these chips or shavings furnished by Mr. Rockwell, shows their exact size and appearance. They are from 3 in. to 5 in. long, and from ⅛ in. to ¼ in. wide, and are curved like a machine tool chip. The outer face is bright and worn quite smooth while the rear face is dull and shows the grain of the metal where it has been torn away from the head of the rail. At the bottom edge the chips are about $^1/_{32}$ in. thick and are rough and jagged. The thickness tapers to a serrated knife edge at the top, and for a depth of about $^1/_{16}$ in. this edge is tempered a deep blue by the action of the heat generated in tearing away the chip. This temper color is clearly shown in the two upper specimens in the illustration.



Shavings Cut from Outer Rail on 16-deg. Curve.
(Scale exact size.)

On this same curve and also in a yard on the Vandalia similar chips have been cut by wheel flanges under heavily loaded cars, but

they are only about one-quarter as heavy as those cut by the engines. In one case on the Vandalia, some new Pennsylvania 100,000-lb. cars cut the rails on a sharp curve, and on investigation it was found that the drawbars did not have sufficient lateral motion and the free movement of the trucks was restricted, thereby causing the wheels to bear against the rail with excessive pressure. Careful observation in the Ashtabula yard showed that quite often in the case of high capacity cars, fully loaded, the car body cants to one side on entering the curve before the truck has had time to assume a radial position and the pressure on the side bearings holds the wheel flanges against the rail hard enough to start the cutting.

It does not seem reasonable that the cutting of the rails is due entirely to the action of the wheel flanges in the case of the six-wheel switch engines at Ashtabula. The tires on these engines were new and a new tire is as unlike a cutting tool as it is possible to imagine. The form of the tread and flange is determined with the one object of preventing such action. From observation of rails laid on tangents and subjected to heavy loads it is known that the pressure of the treads breaks down the structure of the metal and squeezes it out to the sides, usually the inner side, forming a lip or burr. This indicates the presence of vertical or slightly inclined cleavage planes in the metal where the cells have been forced apart and have slid over one another. Exactly the same action takes place on a curve where the rails carry heavy loads and the appearance of the chips cut off seem to confirm the assumption. They have been forced down and broken off in vertical cleavage planes, not curled out from the side of the rail head as would be the case if the wheel flange acted as a true cutting tool. The inside surface of the rail head being rough and the curve sharp, there would be a natural tendency for even a new flange to climb the outer rail slightly and thus break off the chips which were previously loosened from the body of the metal by the vertical pressures of the wheel treads. A new rail would probably not show the effects of the heavy wheel loads until some time after it had been put in the track, but as soon as the breakdown began to take place the cutting could be expected to occur.

The subject is an interesting one and we should be glad to have information from others who have had experience with it.

The total mileage of electric street railways in Great Britain at the end of 1904 was 1,770, equivalent to 2,740 miles of single track. In addition to this there are 17 miles of underground tube railways, seven miles of ordinary tunnel roads and 84 miles of electrically operated standard gage surface lines equivalent to 212 miles of single track. About 380 miles of new tramway and electrified steam roads are under construction.

Railroad Shop Tools.

(Continued.)

LATHES.

The accompanying illustration, Fig. 1, shows a 26-in. screw-cutting engine lathe made by the Hamilton Machine Tool Company, Hamilton, Ohio. The bed of this machine is wide and deep; it is well braced and is provided with large V's. It is mounted on cabinets, which besides affording a firm support for the bed, provide convenient cupboards for the storage of tools and small posts. The headstock in the belt-driven lathe has a five-step cone-pulley and is provided with back gears. The spindle is hollow and is of a crucible steel forging. The spindle boxes are of phosphor bronze and anti-friction thrust-bearings are provided. The centers are of tool steel; these are sent out unhardened, so that the customer may finish the parts to any desired angle to suit the nature of the work to be done. Gear guards are provided for all exposed gears. These not only prevent injury to the workman but they also protect the gears from chips and dirt. The tailstock has a curved front which allows the compound rest to be used at right angles to the cross slide. The tail-spindle is graduated in inches for convenience in drilling; it is of steel and has a long movement. By means of an adjusting screw the tail-stock can be set over for taper turning, but where much taper turning is to be done a regular taper-turning attachment can be furnished.

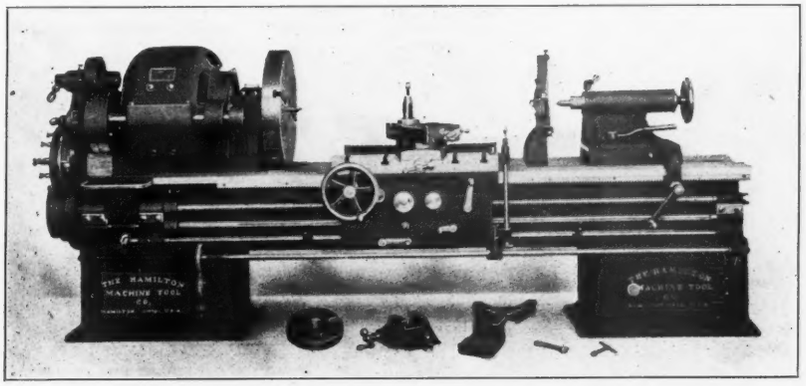


Fig. 1—Hamilton 26-in. Screw Cutting Lathe.

The carriage is large and is securely gibbed to the front, center and back, and is scraped to a solid bearing on the bed throughout its entire length. It is entirely flat on top and is amply provided with T slots, so that work can be easily clamped upon it. Power longitudinal and power cross feeds are provided and the cross feed screw has micrometer adjustment. When cross feed is in use, the carriage can be quickly clamped to the bed by means of a screw conveniently located. All sizes of this type of lathe are provided with a rotating indicator, or chasing dial, located on top of the carriage; this enables the operator to catch the thread quickly and properly without backing the lathe.

The compound rest is large and substantial. It is fitted with taper gibbs and it has long and broad wearing surfaces. The handle of the compound rest is removable and can be taken off when not in use, so as not to interfere with the cross feed handle. The compound rest swivel is graduated in degrees, so that it may be quickly adjusted at any desired angle. The tool post is turned from solid steel and fitted with a tool steel screw. The collar and bottom plate of the tool post are also made of steel and are case hardened.

The apron is tongued and grooved into the carriage, and all parts are strong and of good size. The mechanism is arranged so that it is impossible for both lead screw and feed rod to be engaged at the same time, thus preventing breakages from this source. The longitudinal feed is friction driven, and will pull heavy cuts with ease. Both the longitudinal and cross feeds can be instantly engaged or disengaged by turning the knurled nuts shown at the front of the apron. All feeds are reversible from the apron, by means of the lever near the bottom of the apron toward the left.

The automatic stop can be used in thread cutting as well as in turning, and it operates equally well in either direction. The feeds and screw pitches provided are of wide range. They are produced by a universal screw-cutting and feeding arrangement, which permits all changes of screw pitches or feeds to be quickly made while the lathe is in motion without removing any parts held by bolts or nuts. It also affords a positive geared feed, dispensing entirely with a feed belt.

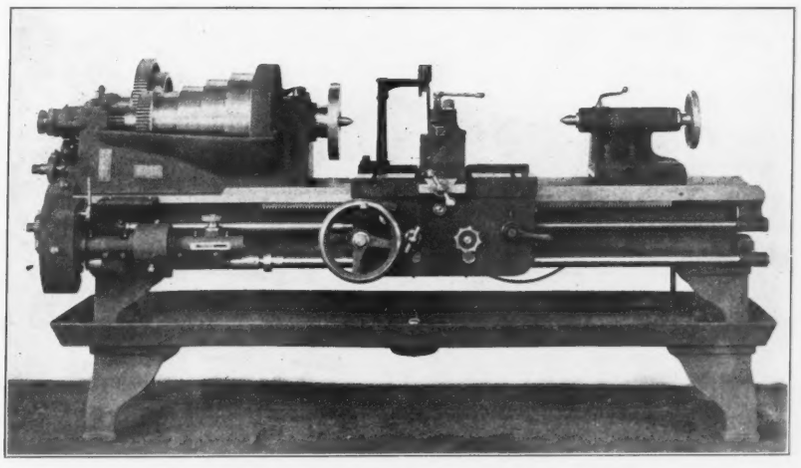


Fig. 2—Reed 18-in. High-Speed Engine Lathe.

The lead screw is used only for screw-cutting, the turning feed being driven from a separate rod, and is therefore not liable to excessive wear. It is cut from a master screw and is not splined; the lead screw nut

is of the usual split pattern, lined with babbitt metal and operated by a cam in such a manner as to secure a firm and even grip.

The double friction countershaft is furnished. This is fitted with large friction pulleys running on self-oiling bushes. It can be oiled without throwing off the belts. The cone pulley is of larger diameter than the one on the spindle, insuring ample driving power, and is flanged at the lower step to prevent the belt from slipping off.

By placing pulleys of different diameters on the line shaft and using two straight belts on the countershaft, 20 different spindle speeds are obtainable; this is double the ordinary range and is especially desirable when using the new high-speed tool steels. As each lathe is provided with a chasing dial to facilitate the rapid cutting of threads, there are but few cases where a backing belt is required.

As shown in the accompanying illustration, when these machines are to be motor-driven, the headstock is designed so as to form an integral part of the motor frame, with supporting sides extending well up towards the center line of the spindle, thereby securing ample strength and stiffness.

A 7½ h.p. variable speed motor is used to drive this machine. The motor has seven speeds in either direction in regular progression, from 95 r.p.m. as the slowest to 350 r.p.m. as the fastest. The motor is controlled by the handle located on top of the carriage at the right. The lathe spindle is triple geared, which, in connection with the seven motor speeds, affords a total range of 21 spindle speeds.

The principle dimensions of this lathe are: Swings over shears, 26½ in.; swings over carriage, 17½ in.; swings over compound rest, 16 in.; takes between centers, on 10-ft. bed, 5 ft.; range of screw pitches (including 11½ pipe thread), ½ to 28 per inch; range of feeds, 4 to 224 per inch; diameter of hole through spindle, 2⅛ in.; ratio of back gearing, 13¼ to 1; size of headstock cone pulley, 6, 8⅝, 11¼, 13⅞ and 16½ in. diameter, 3¾ in. face; traverse of tailstock spindle, 10¾ in.; traverse of compound rest, 6 in.; size of countershaft friction pulleys, 16 in. diameter by 4½ in. face; speeds of countershaft, 100 and 125 r.p.m.; net weight of 10-ft. lathe, 6,000 lbs.

Fig. 2 shows the 18-in. high-speed engine lathe made by the F. E. Reed Company, Worcester, Mass. This is a modern tool in every respect and is especially designed for use with high-speed cutting steels. The spindle is a crucible steel forging and has a 1¼-in. hole through it. The front bearing of the head spindle is 3⅝ in. in diameter x 7½ in. long and it runs in babbitt bearings. The spindle nose is 3½ in. in diameter and it is cut four threads per inch. The cone pulley has four steps for a 3½-in. belt, the largest step being 15 in. in diameter. The illustration shows the lathe as fitted with two ratios of back gears, a small ratio of 4.3 to 1 and a larger ratio of 11.28 to 1. With the open belt and small ratio of back gears, iron and steel can be turned up to 5 in. in diameter, cutting as many f.p.m. as the best high-speed steels will stand. With the large ratio of back gears any work can be done in the lathe from 5 in. in diameter up to the full swing of the lathe. The diameter of the cone pulley and the ratios of back gearing are arranged so that the machine has a regular graduation of spindle speeds of from 400 to 10 r.p.m. As shown in the illustration, a plain rest is furnished. It is extra heavy and has a bearing of 36¾ in. on the bed. The V's on which the rest slides are very wide. A compound rest can be furnished in place of the plain rest when desired. The rest has power feed and the feed-rod is driven by gearing and is supplied with an automatic stop motion. The following feeds are obtainable: $^1/_{40}$, $^1/_{32}$, $^1/_{16}$, ⅛ and $^7/_{32}$ in. per revolution. The carriage is moved by means of a steel rack and pinion. The rack gear can be thrown out of the rack, and thus prevent wear when not in use, such as in screw cutting or similar work. The steel head-screw is cut four threads per inch and is fitted with an open-and-shut nut. Threads from two to 20 turns per inch can be cut on this machine. This tool is mounted in an oil pan and is provided with pump and piping, as shown, so that the cutting tools can be constantly flooded with lubricant. The countershaft has two friction pulleys for speeds of 200 and 240 r.p.m. These pulleys are 16 in. in diameter for a 4-in. belt. The pulleys are arranged so that they may be oiled while running, and the countershaft has self-oiling bearings. Any size of tool may be used in the Universal tool holder which is furnished with this machine. A gear-box for holding the change gears which are not in use is also provided. This lathe, fitted with a 10-ft. bed, swings 5 ft. 6 in. between centers; swings over plain-rest 12¼ in. and over bed 20½ in. The net weight is 5,180 lbs. and it occupies a floor space of 11 ft. 3½ in. x 3 ft. 6 in.

(To be continued.)

Report of the Massachusetts Highway Commission.

With an appropriation of $450,000 to use during 1904 in improving the state highways the Commission reports that it has made additional lay-outs amounting to nearly 61 miles. The number of miles of road finished during the year was approximately 66, making a total of about 548 miles of completed state highways at the end of 1904. The excellent plan for securing local co-operation provided by statute requires a payment to the commonwealth by each municipality in which state roads are built of the cost of maintenance of such roads; not to exceed $50 a mile, however, for each mile of state road in the respective municipalities. The cost of repairs in 1904 was $51,896, about 40 per cent. of which is paid back to the state according to the terms of this arrangement. Entirely apart from the commission-improved roads a very valuable feature of this work, like that of the "good roads" movement instituted by some of the railroads in the South in recent years, is the education of small towns in improving their highways and bringing them up to a commendable state of excellence at no greater cost, or only a little greater cost, than had previously been spent to produce quite unsatisfactory results. The Commission points out that this actual demonstration is worth more to the practical country men than all the theoretical claims that could be made and that it gets much nearer to the people themselves than the construction of more expensive and complete highways does. The commissioners have personally made themselves acquainted with the needs and desires of these small towns and have talked with the selectmen and road superintendents and have aided them by their advice as to where and how the allotted sums should be spent. The Commission has under its control 17 steam rollers and two portable stone-crushing plants. These were purchased primarily for the use of small towns which have made appropriations for building roads but own no road machinery.

Although authorized by the statute, the Commission has not, until the past year, taken up the problem of tree planting along state roads. In the opinion of the Commission, the state highways, extending in places for many miles unbroken, are now of sufficient length to warrant it in adopting a general plan, which can be applied as the roads are built. Therefore, reports have been made showing the land along these roads that is available or desirable for tree planting, and approximately 4,000 trees were set out during the year. Of these, 1,737 were maples, sugar, Norway and white; 1,000 were elms, and 538 were oaks; red, scarlet, white and pin. The total cost of these trees in their final location, including transplanting in a temporary nursery and replanting on the roadway, care, labor, etc., has been $4,348, or an average of $1.14 per tree, and the work has been so carefully done that the percentage of loss has been very small.

The Commission complains that the present laws to regulate automobile traffic are quite unsatisfactory, and that the speed restrictions placed by many of the local communities are in themselves absurd and therefore never enforced. Local requirements are quoted limiting the speed on open roads to a maximum of from four to six miles an hour. It is held that the speed limitation should be made reasonable and that special localities should have special regulations, plainly on sign boards at each end of the road affected.

Street Railway Conduits in London and New York.

The Tramway and Railway World publishes the following table of comparison between the New York and the London County Council conduit system for street railways, compiled by J. Allen Baker, of the London County Council, who recently visited New York in order to make a comparison of American and British street railway systems:

	New York. 210 miles (single track).	London. 54 miles (single track).
Average gross earnings per car-mile	36 cents.	24 cents.
Average operating cost per car-mile (including repairs, renewals and reconstruction, maintenance, accidents, etc.)	15 cents (estimate).	Without renewals. 14 cts.
Average cost per track-mile for conduit cleaning, per annum	$486 est. current year.	$651
Average cost of constructing conduit line per mile of single track (including cable ducts, but not cables)	$97,200 to $121,500	$71,928
Average cost of feeder cables per mile of single track	$15,552	$7,290
Cost of power station and substations per mile of single track	$28,188	$28,431*
Average speed at which cars run	10 miles an hour.	8 miles an hour.
Hours of motormen and conductors	10 hours' labor (in 12 consecutive hours).	10 hours' labor (in 10½ hours average).
Pay of motormen per day	$2.08 to $2.48	$1.14 to $1.50 (74 per cent. at $1.50).
Pay of conductors per day	$1.98 to $2.34	$1.14 to $1.50 (65 per cent. at $1.50).
Pay of conduit cleaners, per day	$1.72	$1.28
Pay of car cleaners per week	$10.54 to $12.24	$6.06 to $6.66

*This figure is based upon obtaining power from the Greenwich generating station with 1,000 cars in operation over 200 miles of single track.

GENERAL NEWS SECTION

NOTES.

Professor W. K. Hatt, of Purdue University, recently lectured before the students of the Yale Forest School on the subject, "Structural Timber in Relation to Substitutes Therefor."

The New York, New Haven & Hartford reports that for the week ending April 1, of the 4,971 passenger trains run by the company to and from the south terminal station, Boston, 4,840, or 97 per cent., reached their destinations on time.

The passenger traffic men of the railroads of Eastern Canada have organized the Eastern Canadian Passenger Association. The territory of the association is to include all of Canada, east of Port Arthur, Sault Ste. Marie and the Detroit river.

A former brakeman of the Gulf, Colorado & Santa Fe has been sentenced to three years' imprisonment for perjury in trying to get damages from the company for an alleged injury. The road's attorney learned that he had swindled the Missouri, Kansas & Texas out of $800.

The German foreign office says that Germany has accepted the proposition of the United States that an engineer be sent from Berlin as a member of the Isthmian Canal Advisory Board. It is understood that similar appointments will be made by the British and the French governments.

Since the slight advance in certain commutation passenger rates on the Long Island Railroad, that company has had a marked increase in sales of commutation tickets, the number sold in February and March being 1,000 greater than in the corresponding months of last year; which rather discredits the claim that the increase in rates would retard the growth of the towns on the island.

The substitution of telephones for the Morse telegraph on railroads, which has been much talked of during the past few years, but which has been carried out but very little, is now actually accomplished at nine stations on the Westchester branch of the Philadelphia, Baltimore & Washington; but the report in a Philadelphia paper that these are train-order stations is not true; and all of the places are, we understand, well accommodated by the Western Union Co. for public telegraph business.

At a conference held April 8 between Secretary Taft and diplomatic representatives from Bolivia, Peru, Ecuador, Chili, Guatemala, Nicaragua and Costa Rica, Secretary Taft assured the foreign diplomats that the United States Government would throw open the ports of Ancon and Colon to all vessels. Heretofore three steamship lines on the Pacific side have been in complete control and have maintained a monopoly of the docking facilities at Ancon. The docks at both the Atlantic and Pacific ports are owned by the Panama Railroad.

The Detroit, Ypsilanti, Ann Arbor & Jackson electric road has been carrying on a lively competition in package and light freight traffic with the Michigan Central and has, for some time, maintained a system of free cartage to meet cuts which were made in the freight rates of the steam road. Announcement is now made that the Michigan Central has restored its freight rates to their former figure and that the electric road has discontinued its free cartage. The steam freight rates on competitive traffic were cut in half during the struggle.

The comptroller of the Treasury Department has rendered a decision holding that the government (the Interior department), in accepting rebates from the railroads on goods consigned to contractors, has violated the Interstate Commerce Law. He holds that the clause authorizing railroads to give reduced rates to the government does not authorize reductions on shipments of machinery for a contractor. The contract for reduced rates which is under consideration is one with the Southern Pacific in connection with goods shipped to contractors doing work on the Salt River irrigation project. One contractor made his bid without knowing that he could have a reduction in freight rates and consequently has ground for complaint.

A Sermon in the Simplon.

[Press despatch of April 2.]

The Simplon tunnel, the longest in the world, was inaugurated this morning when from the Swiss and Italian sides the first trains passed through, meeting at the center, where there was the iron door which originally prevented the overflow of a torrent of hot water, and which was to-day opened for the first time. The weather at the entrance to the tunnel was spring-like, though the surrounding mountains were covered with snow, but once inside the temperature became very high. Engineer Brandau, who had directed the work on the tunnel, conducted the Italian train. The train from the Italian end was the first to reach the iron door, but a little later the train from the Swiss side was heard on the other side of the door. A brief time was spent in communicating through the door by means of hammering, and finally the door was knocked down, amid frantic applause and cries of "Long live Switzerland!" and "Long live Italy!" Bands played the Italian royal march and the Swiss anthem, and the two parties embraced and kissed each other. Engineer Brandau shook hands with Engineer Rosemund, the director of the work on the Swiss side, and the Italian Bishop Noveara embraced the Swiss Bishop Sien. The latter then preached a short sermon, in the course of which he said: "The church blesses progress." In the name of God he then blessed the tunnel.

Illegal Cartage Allowances at St. Louis.

The Interstate Commerce Commission has announced a decision respecting certain terminal allowances at St. Louis and East St. Louis, and at Granite City and Alton, Ill. Carriers operating lines to points west of the Mississippi river make rates to such points which are the same from East St. Louis, Ill., as from St. Louis, Mo. A large portion of the L. C. L. traffic is hauled by team from East St. Louis to the depots of the rail carriers in St. Louis, mostly by regularly organized transfer companies, but to some extent by teams owned by shippers. The rail carriers accept delivery at depots of the transfer companies in East St. Louis, pay the transfer companies 5 cents per 100 lbs. for such transfer to St. Louis, and also pay a like sum to the Grant Chemical Company, a shipper, for a similar transfer of that company's shipments from East St. Louis, but refuse to make such payments to other shippers. The Eclipse Transfer Company was organized for the sole purpose of obtaining these payments; it uses teams owned by the Simmons Hardware Company, and uses the storehouse of the latter for a receiving depot. The Commission holds that the payments to the Grant Chemical Company and the Eclipse Transfer Company are illegal. No opinion is expressed as to whether lines leading west from St. Louis may properly apply the St. Louis rate to the station of a *bona fide* transfer company in East St. Louis and absorb the cost of transfer to St. Louis; nor whether the rail carriers may, by proper schedules, allow all shippers from East St. Louis a fixed sum per 100 lbs. for transporting their merchandise to the carriers' depots in St. Louis, those questions not being presented by the record in this proceeding.

The commission decided that the railroads (short connecting tracks) owned by the St. Louis Syrup & Preserving Co. and by the Illinois Glass Co. were violating the law in accepting divisions of through rates with railroads which are common carriers.

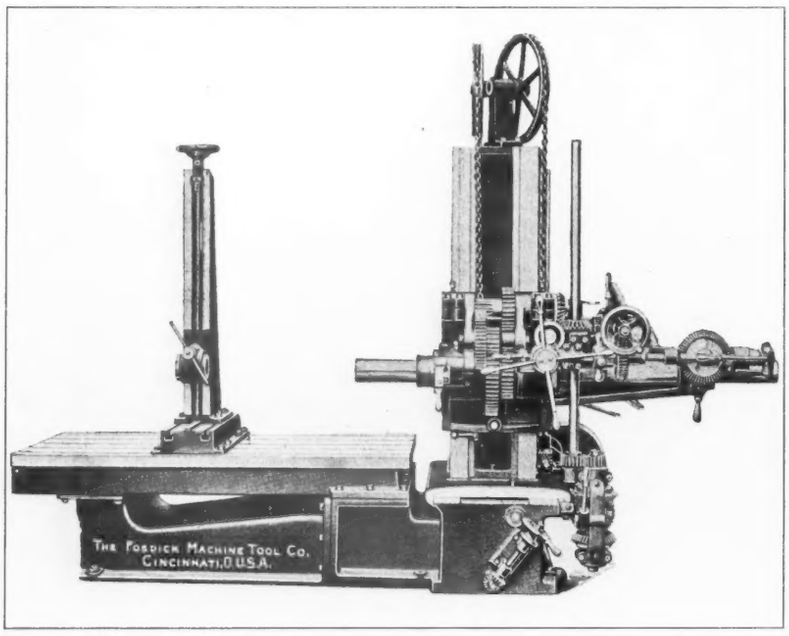
Decision Concerning L. S. & M. S. Annual Reports.

In an opinion by Justice McKenna, the Supreme Court of the United States has decided in favor of the road and has affirmed the decision of the United States Circuit Court for the Northern District of Ohio in the case of the Interstate Commerce Commission against the Lake Shore & Michigan Southern. The suit was brought by the commission to compel the road to comply with an order, issued in 1903, to incorporate in its annual report, tonnage, ton mileage, earnings and receipts per ton per mile on grain, hay, cotton, live stock, dressed meats, anthracite coal, bituminous coal and lumber carried in carload lots. The road did not report these figures and the commission filed a petition for a mandamus to compel a response alleging that the information required is necessary to enable the commission to properly carry on the business for which it was created. The petition was dismissed by the Circuit Court on the ground that it was without original jurisdiction to issue a writ of mandamus that action is now sustained.

Alluding to the contention that there is no question as to the commission's power to require such reports and to enforce obedience to its orders, Justice McKenna asked how this was to be done, adding: Manifestly only in such way as the courts have jurisdiction to give. All powers are given in view of that jurisdiction, and the amendments of the Interstate Commerce act are so framed. Jurisdiction to issue mandamus is conferred by Section 6, to enforce the filing or publishing by a common carrier of the schedules or tariffs of rates, fares and charges. And such jurisdiction also is given the court and district courts upon the relation of any person, firm, or corporation, alleging a violation of any of the provisions of the act which prevents the relator from having interstate traffic moved on terms as favorable as any other shipper. It is clear that when Congress intended to give the power to issue mandamus it expressed that intention explicitly. Such power cannot be inferred from the grant of authority to the commission to enforce the act or from the direction to district attorneys or the Attorney General to institute "all necessary proceedings for the enforcement of the provisions" of the act.

The Fosdick Horizontal Boring, Drilling and Milling Machine.

The horizontal boring, drilling and milling machine shown herewith will perform the various operations of boring, drilling, tapping, reaming, facing, milling, etc., on both light and heavy work economically, accurately and rapidly in its different operations and adjustments. These different operations can be performed on a piece of work fastened to the table in one setting, insuring accurate results. The machine is driven by a splined shaft which traverses the driving cone on the rear of the bed. The column carrying the spindle head has horizontal movement on the bed by hand or power in both directions; also a quick forward and return motion by power operated by a handwheel conveniently located on the front of bed. The spindle head, which is counterbalanced and provided with a safety chain, has vertical movement on the column by hand or power in both directions, and for quick adjustment is easily operated by means of the pilot wheel on the front of the spindle head. The spindle runs in adjustable bronze bearings and has a thread cut on its front part to receive chucks, large milling cutters, facing heads, etc., for very heavy work. It revolves in right or left-hand directions and can be started, stopped or reversed instantly, which is very convenient for facing, tapping, milling and other operations. The spindle bar, which passes through the spindle, is 4 in. in diameter, has 22-in. traverse, and is fitted with a No. 5 Morse taper to receive drills, taps, reamers, boring bars, milling cutters, etc. It has power and hand feed in both directions, is operated from the pilot wheel for quick adjustment and can be securely clamped for face-milling purposes. For very heavy work the cutter or boring bar is secured by a cotter fitted to the spindle bar. The back gears are located on the spindle head, bringing the power direct to the work, thus relieving the outer shafts from unnecessary strain, also reducing the vibration of the cutting tools to the minimum. The lever for operating the back gears is conveniently located on the spindle head, and they can be engaged or disengaged while the machine is running. The outer support for the boring bar can be clamped securely to the table and has horizontal and vertical adjustment. It is provided with graduated steel rules, as is also the face of the column and the bed, the spindle sleeve being graduated. The table in which the T slots are planed is stationary and securely bolted to the bed and base to insure alinement of the work. All the feeds, as horizontal feed of column, horizontal feed of spindle bar and vertical feed of spindle head, are taken from the spindle; they are positive geared, eight in number, by hand or power, and are arranged in geometrical progression from $^{7}/_{1000}$ to ¼ in. per revolution of spindle. All feeds are reversible. The spindle speeds are ten in number, arranged in geometrical progression from 4 to 260 r.p.m. The gear ratio from the cone driving shaft to spindle is 2⅔:1; that is, when the driving shaft makes 2⅔ revolutions, the spindle makes 1. The ratio of back gears is 13.6:1. All bearings are bronze bushed, shafts are ground, and all bevel and miter gears are planed from the solid. The machine is now being made in two sizes, Nos. 1 and 2. No. 3, for much larger and heavier work, will soon be ready. The Fosdick Machine Tool Company, Cincinnati, Ohio, is the maker.



The Fosdick Horizontal Boring, Drilling and Milling Machine.

Railway Appliance Exhibition.

The following firms have become members of the American Railway Appliance Exhibition since the list was last published in the *Railroad Gazette*. The total membership now includes 300 firms, occupying 90,000 sq. ft. of exhibition space, exclusive of aisles or passageways. As previously mentioned, the address of J. Alexander Brown, Secretary and Director of Exhibits, is now The New Willard, Washington, D. C.

Ajax Mfg. Co., Cleveland, O.
American Bridge Co., New York, N. Y.
American Locomotive Appliance Co., Washington, D. C.
American Sheet & Tin Plate Co., Pittsburg, Pa.
American Steam Gauge & Valve Co., Boston, Mass.
American Steel & Wire Co., Pittsburg, Pa.
American Trackbarrow, Lowell Mass.
American Valve & Meter Co., Cincinnati, O.
Atlas Portland Cement Co., New York, N. Y.
Aurora Automatic Machinery Co., Aurora, Ill.
Automatic Valve Grinding Machinery Co., Knoxville, Tenn.
Baker, Wm. C., New York, N. Y.
Barker Mail Crane Co., Clinton, Ia.
Belle City Malleable Iron Co., Racine, Wis.
Border Nut Lock Co., Richmond, Ind.
Bradford Draft Gear Co., Bradford, Ill.
Bradley, Osgood, & Sons, Worcester, Mass.
Bridgeford, Charles, Rochester, N. Y.
Carbon Steel Co., New York, N. Y.
Chicago Varnish Co., Chicago, Ill.
Chilton Paint Co., Chicago, Ill.
Cleveland City Forge & Iron Co., Cleveland, O.
Converse, W. W., & Co., Palmer, Mass.
Cooper-Hewitt Electric Co., New York, N. Y.
Crane Company, Chicago, Ill.
Crocker-Wheeler Co., Ampere, N. J.
Curtain Supply Co., Chicago, Ill.
Davis Pressed Steel Co., Wilmington, Del.
Detroit Lubricator Co., Detroit, Mich.
Detroit Seamless Tube Co., Detroit, Mich.
Diamond Rubber Co., Akron, O.
Eastern Granite Roofing Co., New York, N. Y.
Edwards, O. M., Co., Syracuse, N. Y.
Electric Controller & Supply Co., Cleveland, O.
Electro-Dynamic Co., Bayonne, N. J.
Elliot Frog & Switch Co., East St. Louis, Ill.
Empire Safety Tread Co., Brooklyn, N. Y.
Federal Company, Chicago, Ill.
Foster, Walter H., New York, N. Y.
Franklin Mfg. Co., Franklin, Pa.
Franklin Ry. Supply Co., Franklin, Pa.
Garlock Packing Co., New York, N. Y.
Gehr, Harvey J., Waynesboro, Pa.
German-American Car Lines, Chicago, Ill.
Gould, W. F., & Co., Des Moines, Ia.
Hageman Metallic Hose Co., Chicago, Ill.
Hart Steel Co., New York, N. Y.
Hewitt Mfg. Co., Chicago, Ill.
Hill, Clarke & Co., Boston, Mass.
Home Rubber Co., Trenton, N. J.
Hunt Spiller Mfg. Co., So. Boston, Mass.
Hussey-Binns Shovel Co., Pittsburg, Pa.
Illinois Steel Co., Chicago, Ill.
Industrial Works, Bay City, Mich.
International Creosoting & Constr. Co., Galveston, Tex.
International Fence & Fireproofing Co., Columbus, Ohio.
Iron City Tool Works, Pittsburg, Pa.
Johnson, J. H., & Co., Richmond, Va.
Keefer Railway Tie Co., Cincinnati, O.
Kennicott Water Softener Co., Chicago, Ill.
Kent, Edwin R., & Co., Chicago, Ill.
Kerr Turbine Co., Wellsville, N. Y.
Kinsman Block System, New York, N. Y.
Lembcke & Co., New York, N. Y.
Leslie, J. S., Paterson, N. J.
Locomotive Appliance Co., Chicago, Ill.
Lorain Steel Co., Philadelphia, Pa.
Madeira, Hill & Co., Philadelphia, Pa.
Manufacturing Co., The, Carlisle, Pa.
Maryland Steel Co., Philadelphia, Pa.
Matthews-Northrup Works, Buffalo, N. Y.
Merrill Stevens Mfg. Co., Kalamazoo, Mich.
Midvale Steel Co., Philadelphia, Pa.
Miller Anchor Co., Norwalk, O.
Monarch Coupler Co., Detroit, Mich.
Morse Code Tel. Signal Co., Milwaukee, Wis.
National Tube Co., Pittsburg, Pa.
Nernst Lamp Co., Pittsburg, Pa.
Nichols, Geo. P., & Bro., Chicago, Ill.
Norton Grinding Co., Worcester, Mass.
Ohio Injector Co., Chicago, Ill.
Otto Gas Engine Works, Chicago, Ill.
Pitt Car Gate Co., New York, N. Y.
Prosser, Thomas, & Son, New York, N. Y.
Quaker City Rubber Co., Philadelphia, Pa.
Railway Review, Chicago, Ill.
Railway Steel-Spring Co., New York, N. Y.
Ralston Car Co., Chicago, Ill.
Reed, F. E., Co., Worcester, Mass.
Robins Conveying Belt Co., New York, N. Y.
Rostand Mfg. Co., New Haven, Conn.
Rouy, G., New York, N. Y.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Sellers, Wm., & Co., Inc., Philadelphia, Pa.
Simmons Hardware Co., St. Louis, Mo.
Sipe, Jas. P., & Co., Allegheny, Pa.
South Atlantic Car & Mfg. Co., Waycross, Ga.
Spaulding Print Paper Co., Boston, Mass.
Swan & Finch Co., New York, N. Y.
Tyler Tube & Pipe Co., New York, N. Y.
U. S. Steel Products Co., New York, N. Y.
Universal Railway Supply Co., Baltimore, Md.
Vacuum Cleaner Co., New York, N. Y.
Ward Railway Supply Co., Chicago, Ill.
Washburn Co., Minneapolis, Minn.
Waugh Draft Gear Co., Chicago, Ill.
Wells Light Mfg. Co., New York, N. Y.
Williams, Brown & Earle, Philadelphia, Pa.
Wilson, Jas. G., Mfg. Co., New York, N. Y.
Yawman & Erbe Mfg. Co., Rochester, N. Y.

Compliance With Coupler Law on P. R. R.

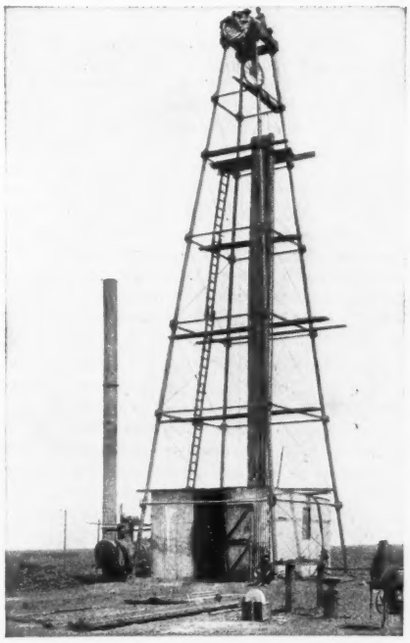
The Pennsylvania Railroad and the companies included in the Pennsylvania Lines West of Pittsburg have issued notices to connections that freight cars will not be received, either empty or loaded, which do not fully comply with the requirements of the federal law requiring safety appliances. These requirements are: Couplers which will couple automatically by impact and which may be uncoupled without the necessity of a man going between the ends of the cars; power brakes in each train on at least half of the cars, and on enough cars to control the speed of the train.

Reading Dining Cars.

The Philadelphia & Reading has established a dining car department and has appointed as Superintendent S. W. Derr, late of the Baltimore & Ohio. Dining cars are to be put in service on some of the trains between New York and Philadelphia and probably on other Reading lines.

Deep Drilling in South Africa.

Diamond drilling as a means of locating the gold-bearing reefs of the Transvaal has been in general practice for many years. Unusual interest attaches to it at the present time owing to the large number of deep holes which are being sunk to prove the existence and position of the ore bodies at increasing distances from the outcrop. For this work larger and larger drills have been



Rig for Deep Drilling.

used and within the past year or two numerous bore holes have been bottomed in ore at depths of from 4,500 to 5,000 ft. Upward of 300 diamond drills are now in use in South Africa, including a large number of "Sullivan" and "Bullock" types made by the Sullivan Machinery Company, Chicago. For the deep holes referred to, the Sullivan improved Class P, rated capacity 4,000 ft., is used. The mining companies as a rule let the work to contractors, who furnish all of the equipment and expert operators, and deliver the core into the hands of the company. American contractors have recently broken all records for depth. James Tobin completed a bore hole last December at Doornkloof, 16 miles west of Randfontein, at a depth of 5,560 ft. This hole was sunk to prove the main reef series, and it is understood that the results are conclusive, although they have not been made public. The deflection was very slight. The first 3,200 ft. were bored with a Sullivan Size N drill, rated capacity 2,000 ft. A Size P, rated at 4,000 ft., was then substituted and continued the hole to completion at 5,560 ft. For the first 700 ft. Size N rods, removing a 2-in. core, were used. Size B, removing a 1⅜-in. core, was used for the remaining 4,860 ft. The total load on these rods was between 15 and 16 tons, which was handled by the engine without difficulty. The actual running time of this hole was 14 months, or an average of nearly 400 ft. per month. For the first two months two ten-hour shifts were used, and for the rest of the time the work was carried on during the entire 24 hours, divided into three eight-hour shifts. The rods were pulled in lengths of 50 ft., the height of the tubular steel derrick being 66 ft. over all. The time required to lower the rods at a depth of 5,000 ft. was from 3 to 3½ hours, and from 3½ to 4 hours was required to lift them.

This record has since been bettered by a hole sunk near Springs, east of Johannesburg, by John Skenke. This latter hole was begun May 1, 1904, and completed Feb. 2, 1905, at a depth of 5,582 ft. A Size P drill was used here also, power being supplied by a 30-h.p. boiler. Size N (2-in. core) rods were used for the first 1,000 ft., the remainder of the equipment being similar to that used by Tobin.

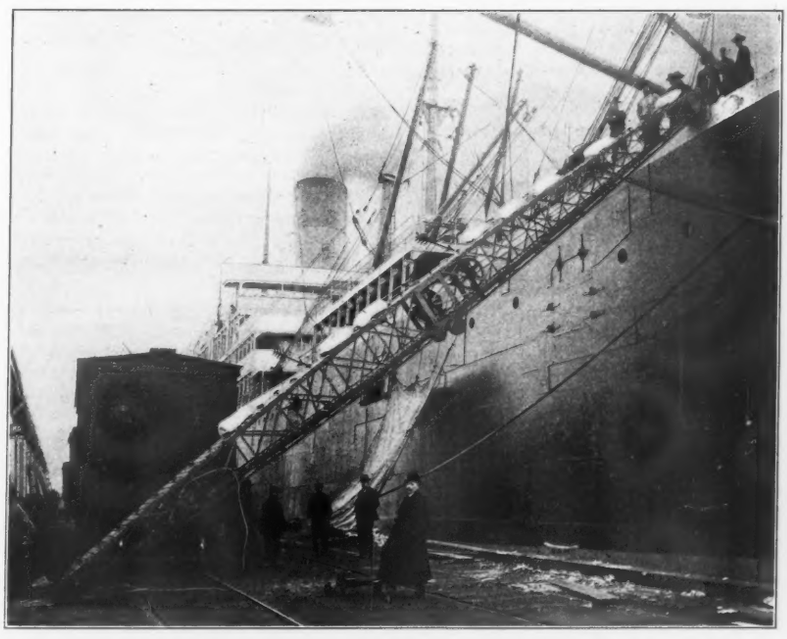
The Spence Registering Conveyor.

The accompanying engraving shows a portable conveying device, intended primarily for loading and unloading ships, although adaptable for other use. As may be seen, it has a steel trussed frame, which pivots at the lower end on truck wheels, enabling it readily to be transported. The endless conveyor is of wooden slat construction, in preference to a belt, as being better adapted for carrying the various commodities handled in shipping. The conveyor rests on steel anti-friction roller-bearing rollers on each side, 2 in. apart. An electric motor drives the conveyor by means of chains and gearing, the motor being equipped with a sliding base to permit adjustment. The range of speed of the conveyor is from 75 to 175 f.p.m., and its maximum capacity is between 4,000 and 5,000 packages an hour.

The device is self-registering. The conveyor is divided into "compartments," each of a size suitable for a single package, by means of lugs along its length at regular intervals. In the center of each "compartment" is a press-button with a downwardly-projecting pin. When the button is depressed by a package, the pin strikes the arm of a counter, enabling automatic record of the number of packages to be kept.

Auxiliary conveyors may be attached to the ends of and driven from the main conveyor by sprockets and chains. Also separate conveyors may be used in conjunction with the registering conveyor to carry freight from the interior of a warehouse and deposit it on the main conveyor, enabling a large area to be cleared in a minimum of time; or the reverse operation is possible, as unloading and storing freight may be done as readily by reversing the motor. The conveyor may be stopped instantly by pressing a push-button at the top of the machine.

The self-registering conveyors are supplied in any length from 16 to 50 ft., with back-geared motors to suit any current. The Spence Registering Conveyor Co., St. Paul, Minn., is the maker.



Registering Conveyor, Loading the Minnesota.

Canadian Tax Inquiry.

The Railway Taxation Commission appointed by the Ontario Government, Messrs. Pettypiece, Shortt and Bell, has presented its report. The commission made extensive inquiries in various states of the U. S. A. It recommends the substitution of a tax of 3 per cent. of the gross receipts of railroads for the present provincial tax of $30 per mile on roads of 150 miles in length and $15 per mile on shorter lines, and the adoption of a system of adjustment between the province and the municipalities on the following lines: The assessment on real estate within each municipality to be determined locally as at present. Then by deducting from the total provincial taxes of each corporation the portions to be paid in the various municipalities, the difference would represent the share going to the provincial treasury. The commission recommends the appointment of a provincial board of taxation with permanent secretaries, to gather statistics; and that telegraph, express and sleeping car companies be taxed on gross receipts according to their ability to pay.

Carey's Roofing Material.

The Philip Carey Manufacturing Company, Lockland, Ohio, has recently completed its new factory for the production of roofing materials, which is one of the largest and most modern plants of its kind. This company has been making roofing since 1873, its best-known product being Carey's magnesia flexible cement roofing, for which many points of excellence are claimed. The body of the roofing consists of a solid, flexible, asphalt cement composition, tempered in the process of manufacture so as to resist the effect of any range of heat or cold reached in the extreme north or south, without drying out or cracking from expansion or contraction. This asphalt body is protected by the outer covering against the action of corroding fumes, gases, heat, steam and other destructive agencies. It is claimed that it is less expensive to lay than tin, slate or tar and gravel roofs, and that it will afford better protection against fire than a tar and

gravel covering. This product is supplied in rolls containing enough material to cover 100 sq. ft. and it can be laid either on flat or steep sloped surfaces by ordinary, careful labor. Other products of the same company which are also in general use in large quantities are the 2-ply and 3-ply, burlap center and standard freight car roofing, all being composition roofs of slightly different structure and grades. They are supplied in rolls 60 in. wide and are made by special processes to enable them to resist the variations in temperature and vibrations which are experienced in service.

The Second Hudson River Trolley Tunnel.

Ground was broken on Thursday, April 13, for the second tunnel under the Hudson river which is one of the projects of the New York & Jersey Company. The tunnel will extend from the foot of Cortlandt street, New York, under the river to the foot of York street, Jersey City, passing under the yards of the Pennsylvania Railroad. Trolley cars only will be run through it. The first tunnel of the New York & Jersey Company, extending from the foot of Morton street, Manhattan, to Hoboken, is nearing completion. The north tube, which was opened about a year ago, is cleaned out and lined ready for laying the tracks, and excavation in the south tube is nearly done. It is expected that the two shields will meet by May 1, and after that the work of finishing both tubes will be rapidly pushed. Cars will probably be running under the Hudson by next winter.

Fame at Short Notice.

On a new branch of the Canadian Northern in Saskatchewan there is a station named Kuroki, for the Japanese general, and another named Osler for the man charged with inventing a chloroform time-limit.

Mont Blanc Electric Railroad.

The French scheme to build an electric railroad up Mont Blanc was before Paris investors in February, and $200,000 was subscribed. When this line is in operation travellers will be carried to the summit of the mountain for about $10, or something like one-sixth of the present cost of hiring a guide.

Manufacturing and Business.

Mr. Clarence E. Newman, of Albany, N. Y., has been appointed Assistant Treasurer and Secretary of The Federal Railway Signal Company, with office at the works of the company at Troy, N. Y.

The Morse Iron Works Co., Erie, Pa., has been organized, with a capital stock of $100,000. The directors are: William Hamilton, R. J. Saltsman, George Schaal, Thomas G. Morse, John VanGeem, Paul A. Benson and B. B. Whitley.

The American Malleable Co., of New Jersey, has been incorporated with a capital of $250,000 in New Jersey to make railroad appliances, by William Conover, Henry A. Miller and others, of Jersey City.

The Link Chain Belt Co., of New York, has been incorporated with a capital of $250,000 to make iron and steel by M. B. Bloomer, of Cranford, N. J.; Harry Heath, of Brooklyn; Thomas A. McCabe, of York, and others.

The partnership between George Best and B. K. Elliott, known as the Elliott Electric Blue Print Company, has been dissolved by the sale of all property and business to the B. K. Elliott Company, a corporation, 723 Liberty avenue, Pittsburg, Pa.

The City of Rio de Janeiro, Brazil, which has hitherto been lighted by oil and gas, is planning to install electric light plants and electric traction lines throughout the city. The General Electric Co. has secured the contract, which will amount to about $4,000,000.

Announcement has been made of the resignation of J. R. Phillips, District Manager of the American Sheet & Tin Plate Co., from the United States Steel Corporation. Mr. Phillips with other Pittsburg men has bought a sheet and plate mill at Clarksburg, W. Va.

Mr. Richard Devens, who has for some years been connected with the European office of the Brown Hoisting Machinery Company, Cleveland, Ohio, has been appointed manager of their New York office, 26 Cortlandt street, to succeed Mr. W. A. Stadelman, who has resigned.

The City Council of Chicago has passed an ordinance for the abolition of 63 grade crossings and providing for track elevation to cost nearly $4,000,000. The roads affected are the Pennsylvania, the Lake Shore, the Baltimore & Ohio, the Chicago & Western Indiana and the Rock Island.

The American Water Softener Company, Philadelphia, reports that the Norfolk & Western has placed an order with them for a 250,000 gallons per day water softening plant for the roundhouse at Columbus, Ohio. This plant takes the place of a 100,000 gallons per day plant installed there a year ago, but which proved too small.

The International Mercantile Marine Company and the Cunard Line have offered to lease six piers and two one-half piers of the Chelsea Improvement in the North River, New York City. The former wants four piers and a half pier, and the Cunard Line two piers and a half pier. They agree to pay a yearly rental of $71,350 for each whole pier and $35,675 for each half pier.

According to reports from Ottawa, the Railway Committee has granted incorporation to the International Terminal & Bridge Co. to build a bridge over Rainy river from Fort Francis to the International falls. The capital of the company is $100,000, and the incorporators include: E. W. Backus, of Minneapolis; John P. Staunton, of Hamilton, Ont.; R. A. Grant, of Toronto, and others.

The Trinity Building, 111 Broadway, one of the largest and most modern buildings in New York City, will be ready for occupancy about May 1st. The National Electric Company, Milwaukee, Wis., maker of Christensen airbrakes and electrical machinery, will move into a new suite of offices on the 12th floor of this building from its present quarters at 135 Broadway, which are too small to accommodate the increased sales organization.

The Pennsylvania Company will spend $100,000 in the extension of docks at Ashtabula. Most of the docks will be lengthened 1,000 ft. A retaining wall 30 ft. high and a half mile long will be built at the docks, and on top of this wall a track will be laid, giving direct connection between the upper yard and the lake front. Other work for which plans are being drawn includes a new pier. A new coal-loading machine will be installed.

The Alliance Machine Co. and the Morgan Engineering Co., both of Alliance, Ohio, recently placed orders with the Westinghouse Electric & Manufacturing Co., Pittsburg, for an aggregate of 120 crane motors for both alternating and direct current. These motors represent a total of 2,000 h. p., and vary in size from 1 to 100 h. p. each. The Pennsylvania Railroad at the same time placed an order for 20 induction motors for shop use and the Bethlehem Steel Co. also entered an order for a large number of direct current motors, to be used in its mills.

The International Acheson Graphite Co., Niagara Falls, N. Y., has made arrangements with the Sherwin-Williams Company by which the latter becomes the sole manufacturer in the United States and Canada of Acheson graphite paint. Acheson graphite is made by heating anthracite coal in an electric furnace at a temperature which vaporizes and drives off all impurities and converts the carbon form of the coal into pure graphite. This graphite is claimed to possess inherently the requisite characteristics of an ideal pigment for protective paints for metal surfaces.

According to reports the steamer Minnesota, to sail this month from Tacoma and Seattle for Japan, will carry over 400 carloads of machinery. The largest shipment consists of 40 narrow-gage locomotives probably for use on the new Korean Railroad built by the Japanese from Fusan to Seoul and Chemulpo. The other machinery includes factory equipment, comprising dynamos, shafting, steel plates and lathes ordered by the Japanese Government early in December and intended for the enlargement of the Japanese marine works, where Japanese and captured Russian war vessels will be repaired.

The Niles-Bement-Pond Company has leased an entire floor in the new Trinity Building at 111 Broadway, New York, and will be located there after May 1st. As is well-known, the executive offices have been located in New York since the organization of the company under its present title. The Niles-Bement-Pond Company employs about 5,000 workmen, and has two factories in Philadelphia; one in Hamilton, Ohio; one in Plainfield, N. J., and it also owns the Pratt & Whitney Company at Hartford, Conn., thus making this company by far the largest builder of metal-working machinery in the world.

The Chicago Pneumatic Tool Company reports a most prosperous first quarter's business for 1905. The booking of orders for the three months just past compared with the corresponding period of 1904 is as follows:

	1904.	1905.
January	742	1,221
February	834	1,200
March	869	1,934
	2,445	4,355

This increase, which amounts to 78 per cent., is also a good index to the improvement in general business conditions over a year ago.

The Diamond Chain Factory, at Indianapolis, Ind., has been purchased from the Federal Manufacturing Company by the Diamond Chain & Manufacturing Company, headed by Lucius M. Wainwright, who for the past five years has been the manager of the plant. The new company is incorporated under the laws of Indiana, with a capital stock of $400,000. The officers are: President, L. M. Wainwright; Vice-President, E. C. Dunmeyer; Secretary and Treasurer, A. D. Johnson. The Diamond Chain factory has been in operation since 1890, and the growth of the business has twice necessitated enlarged quarters. The full capacity of the plant in all of its departments is five million feet per year, and the number of employees varies from 250 to 300.

Iron and Steel.

The Lackawanna Steel Co., it is said, is putting up six additional open-hearth furnaces at its works near Buffalo, N. Y.

The aggregate orders booked by the American Bridge Co. within the last four weeks exceed 50,000 tons. The leading independent mills are also obtaining good contracts, and are getting full prices.

Among the largest contracts recently

placed is the order for 20,000 tons of structural steel for the new plants of the National Tube Co., of McKeesport, Pa.; the contract for 8,000 tons for a new building in Chicago, and for 4,000 tons of track elevation for the New York Central.

The United States Steel Corporation, according to reports from Pittsburg, is planning to buy the Mesta Machine Company's Works at West Homestead, and will in future be able to make there most of its rolling machinery and probably steam engines for many of its subsidiary plants.

The statement of the Department of Commerce and Labor shows exports of iron and steel manufactures from the United States for the first eight months of the present fiscal year of $85,000,000. The previous high record was, for the same period in 1901, $81,500,000. The imports this year were $14,000,000.

Eastern mills have taken additional contracts for 25,000 tons of standard rails. The Lehigh Valley has ordered 5,000 tons; the Philadelphia & Reading 10,000 tons, and the Minneapolis, St. Paul & Sault Ste. Marie 5,000 tons. Several other lots of 1,000 and 2,000 tons make up the total tonnage. There are several other contracts pending, in all about 60,000 tons.

The Youngstown Sheet & Tube Co., Youngstown, Ohio, in addition to the Bessemer steel plant which it intends to build, will, it is said, put up mills for the rolling of billets and steel bars, to include a 10-in. mill, a plate mill and several smaller mills for the rolling of lighter finished products. An expenditure of $2,500,000 has been authorized by the stockholders for these improvements.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad conventions and engineering societies see advertising page 24.)

New England Railroad Club.

At the meeting of this club April 11, a paper on the Curtis steam turbine, with illustrations, by Chas. B. Burleigh, was presented.

Engineers' Club of Philadelphia.

At the regular meeting of this club to be held April 15 a paper on "The Electrical Engineer in Heavy Traction Work," by Wm. McClellan, illustrated by lantern slides, will be presented.

American Association for the Advancement of Science.

The Chairman of Section 1 (social and economic science) of this association is Hon. Martin A. Knapp, the Chairman of the Interstate Commerce Commission, and the Secretary is Dr. John Franklin Crowell, of Washington (1102 Fourteenth street, N. W.). The other members of the sectional committee are: Judge Simeon E. Baldwin, of New Haven; Mr. H. T. Newcomb, of Washington; E. L. Corthell, C. E.; Carroll D. Wright, B. E. Fernow, Frank R. Rutter and William R. Lazenbey.

PERSONAL.

—Mr. C. H. Ackert, who has just been appointed Fourth Vice-President in charge of Operating Departments of the Southern, with headquarters in Washington, was born Feb. 19, 1856, and entered railroad service in 1873, as a telegraph operator on the St. Louis, Kansas City & Northern. In 1888 he was appointed General Manager of the Iowa Central. From this position he went in 1893 to the Elgin, Joliet & Eastern as General Manager, and later became President and General Manager of that company and of the Chicago, Lake Shore & Eastern. In 1901 he was appointed General Manager of the Mobile & Ohio, from which position in March, 1902, he was promoted to be General Manager of the Southern, which position he has filled until now.

The accompanying portrait of Mr. Ralph Peters, recently elected President of the Long Island railroad, was not available at the time his election was announced, last week. A sketch of his life will be found in the issue of April 7, page 108.

—Mr. R. E. Smith, who, on April 1, was appointed General Superintendent of Motive Power of the Atlantic Coast Line, with headquarters at Wilmington, N. C., was born in Reading, Pa., and graduated from Phillips Academy at Andover, Mass., in the class of 1882. In that year he entered railroad service as a machinist's apprentice on the Philadelphia & Reading. From this road he went to the Norfolk & Western in December, 1884, as special apprentice. A year later he was made draughtsman, which position he held for 11 months to November, 1886, when he was appointed Foreman at Norfolk, Va., and in October, 1890, Road Foreman of Engines. In January, 1897, he became Fuel Agent of the Atlantic Coast Line, and Superintendent of Motive Power of the same road one month later. This position he held until July, 1898, when he was appointed Assistant to the General Manager. He now returns to the greatly enlarged motive power department.

—Mr. George F. Lupton, who on April 1 became General Passenger Agent of the San Antonio & Aransas Pass, began his railroad career in 1883 as General Southwestern Agent of the Queen & Crescent at Dallas, serving in that city and in Houston until 1888. In that year he became Commercial Agent of the St. Louis, Arkansas & Texas at Houston, remaining there until the following year, when he became City Ticket and Passenger Agent at San Antonio for the Southern Pacific. In 1893 he became Ticket Agent for the San Antonio & Aransas Pass. From June 1, 1893, to May 15, 1897, he was Chief Clerk to the General Passenger Agent of the San Antonio & Aransas Pass, and was then promoted to be Assistant General Passenger Agent, which position he has held up to his present promotion.

ELECTIONS AND APPOINTMENTS.

Atchison, Topeka & Santa Fe.—John B. McCullough has been re-elected Director, succeeding the late R. Somers Hays.

Baltimore & Ohio.—E. D. Smith, Assistant General Passenger Agent at Pittsburg, has resigned to go into other business.

O. J. Kelly, who has been Master Mechanic, with headquarters at Parkersburg, W. Va., has been transferred to Grafton, W. Va., to succeed W. S. Galloway, transferred.

Bangor & Aroostook.—W. M. Brown has been made General Superintendent.

Bath & Hammondsport.—J. C. Stuart has been appointed General Manager; R. H. Wallace, General Passenger Agent, and Henry Adams, General Freight Agent. All hold the same positions on the Erie.

Canadian Pacific.—The office of Fred S. Darling, Division Engineer of Construction of the Eastern Lines, has been moved from Montreal to Toronto, where he is to have charge of the building of the new line from Toronto to Sudbury.

Chesapeake & Ohio.—H. Pierce has been appointed Engineer of Construction, with headquarters at Richmond, Va., succeeding F. I. Cabell, transferred.

Chicago Great Western.—A. Munster, heretofore Acting Chief Engineer, has been appointed Chief Engineer.

The General Passenger Department has been moved from Chicago, Ill., to St. Paul, Minn.

Chicago, Peoria & St. Louis of Illinois.—L. P. Atwood, formerly Superintendent of the Rio Grande, Sierra Madre & Pacific, has been appointed Engineer of Maintenance of Way, with headquarters at Springfield, Ill.

Chicago, St. Paul, Minneapolis & Omaha.—James B. Sheean has been appointed General Attorney, succeeding Pierce Butler, whose resignation is to take effect May 1.

Thomas Marshall has been appointed Master Mechanic, with headquarters at St. Paul, Minn.

The office of E. E. Nash, Assistant Superintendent of the Wisconsin Division,

has been transferred from Itasca, Wis., to Eau Claire, Wis.

Chicago Terminal Transfer.—E. N. Layfield has been appointed Chief Engineer, succeeding F. E. Paradis, resigned.

Cincinnati, Hamilton & Dayton.—I. L. Carroll has been elected Secretary and Treasurer, with office at New York, succeeding C. L. Horton, resigned. See Pere Marquette.

Cleveland, Cincinnati, Chicago & St. Louis.—J. S. Sweeney has been appointed Superintendent of the Cairo Division, with headquarters at Mt. Carmel, Ill., succeeding Thos. Reynolds, resigned.

Colorado & Southern.—See Colorado Springs & Cripple Creek District.

Colorado Springs & Cripple Creek District.—L. F. Linney has been elected Secretary, in addition to his office of Auditor. F. S. McNamara has been appointed General Purchasing Agent, with office at Denver; H. W. Cowan has been appointed Chief Engineer, with office at Denver; T. L. Waggener, Resident Engineer, with office at Colorado Springs; J. D. Welsh, Superintendent Car Service, with office at Denver; J. Munday, Superintendent of Telegraph, and R. H. Doolittle, Claim Agent, all with offices at Denver. C. L. Wellington has been appointed Traffic Manager; J. H. Young, General Superintendent, and F. H. McNaught, Chief Surgeon, all with offices at Denver. F. C. Smith has been appointed Superintendent, with office at Colorado Springs, and A. L. Studer, Superintendent of Motive Power, with office at Denver. H. J. Wall has been appointed Superintendent of Dining Cars and Hotels, with office at Denver. All hold similar positions on the Colorado & Southern.

Denver & Rio Grande.—W. H. Simmons, who has been Acting General Manager of the Denver, Northwestern & Pacific, has been appointed Assistant to the General Manager of the Denver & Rio Grande.

Denver, Enid & Gulf.—J. L. Soule has been appointed Auditor, with office at Enid, Okla., succeeding J. J. Cunningham, General Freight and Passenger Agent, who has been Acting Auditor.

Denver, Northwestern & Pacific.—W. A. Deuel, who has been Superintendent of the Union Pacific at Omaha, has been appointed General Manager of this company, succeeding to the place left vacant by A. C. Ridgway, who on March 1 was appointed General Manager of the Denver & Rio Grande.

See Denver & Rio Grande.

Eastern Texas.—W. P. Smith has been appointed Auditor and Treasurer, with office at Lufkin, Tex., succeeding E. H. Payne, resigned.

Erie.—See Bath & Hammondsport.

Evansville & Indianapolis.—See Evansville & Terre Haute.

Evansville & Terre Haute.—H. J. Miller, General Manager of the Chicago, Rock Island & Pacific, has been elected Second Vice-President of this company and of the Evansville & Indianapolis, succeeding R. R. Hammond.

Great Northern.—G. I. Sweney has been appointed Assistant General Freight Agent, with headquarters at St. Paul, succeeding W. P. Kenney, promoted. M. J. Costello has been promoted from Division Freight Agent to General Industrial Agent.

See Spokane Falls & Northern.

Illinois Central.—O. M. Dunn, formerly Superintendent of the Louisiana division, has been appointed Superintendent of Terminals, at New Orleans.

Illinois Southern.—R. J. Farrell, Master Mechanic, with headquarters at Sparta, Ill., has resigned.

Indiana, Illinois & Iowa.—G. J. Grammer, Vice-President of the Lake Shore, in charge of Traffic, has been elected a Vice-President of this company.

Indiana State Railroad Commission.—The members of this new body are: Union B. Hunt, C. V. McAdams and W. J. Wood. C. B. Riley, Secretary of the Indiana Shippers' Association, has been appointed Secretary of the Commission.

Interoceanic of Mexico.—H. A. McCulloch has been appointed Terminal Superintendent, with office at Vera Cruz. Thomas Smithurst has been appointed Acting Superintendent of Motive Power, with headquarters at Puebla, succeeding W. Cockfield, Locomotive and Car Superintendent.

Lake Shore & Michigan Southern.—See Indiana, Illinois & Iowa.

Lehigh & New England.—H. F. Baker has been elected Secretary and Treasurer, with office at Philadelphia, Pa., succeeding Joseph R. Sagee. J. F. Hoffmeister has been appointed Assistant Secretary, with office at Philadelphia, and F. S. Fowler, Assistant Treasurer, with office at Pen Argyl, Pa. W. H. Hartney has been appointed Auditor, with office at Pen Argyl, succeeding F. S. Fowler.

Long Island.—At the annual meeting of the stockholders, the following directors were elected: Ralph Peters, A. J. Cassatt, David C. Green, T. DeWitt Cuyler, John P. Green, Charles E. Pugh, S. M. Prevost, Samuel Rea, August Belmont, J. H. Hyde, Charles M. Pratt, Jr., Dumont Clarke, and Walter G. Oakman.

Louisville & Nashville.—S. S. Roberts, who has been Roadmaster at Elizabethtown, Ky., has been appointed Assistant Engineer and Roadmaster of the Louisville terminals at Louisville, Ky.

Manistee & Grand Rapids.—H. S. Rogers has been appointed Chief Engineer, succeeding Aug. Fronhoefer.

Missouri, Kansas & Texas.—W. E. Brown has been appointed Superintendent, with headquarters at Oklahoma City, Okla. T., succeeding J. O. Whitmarsh, resigned.

Mobile & Ohio.—J. M. Denyven has been appointed General Freight Agent, with headquarters at St. Louis, succeeding Haiden Miller, promoted to the office of Freight Traffic Manager. N. M. Leach has been appointed Assistant General Freight Agent, in charge of freight traffic, with headquarters at New Orleans; J. S. Taylor has been appointed Assistant General Freight Agent, in charge of freight traffic in the Mobile district, with headquarters at Mobile; and J. T. Poe, General Agent, in charge of cotton traffic, with headquarters at Mobile.

National of Mexico.—The following changes in directors have been made: Retired—E. C. Henderson, J. N. Navarro, W. G. Raoul, G. W. Wickersham, M. de Iturbe and J. de Landa y Escandon. New Directors—Joseph P. Cotton, Jr.; M. M. Reynolds, Jose M. de Landero, Pablo Macedo, Santiago Mendez and Cayetano Romero. Re-elected—E. N. Brown, Guillermo de Landa y Escandon, C. H. Dodge, Adrian Iselin, Jr.; L. F. Loree, J. G. Metcalfe, Charles H. Tweed, Emilio Velasco and James N. Wallace.

New Orange Four Junction.—See Rahway Valley.

Newton & Northwestern.—H. B. Sutton has been appointed Master Mechanic, with headquarters at Boone, Iowa, succeeding L. L. Collier, resigned.

New York & Ottawa.—The authorities of J. F. Deems, General Superintendent of Motive Power and Equipment; F. E. Herriman, General Coal Agent, and H. W. Henry, Assistant General Coal Agent, of the New York Central, have been extended over this road.

New York Central & Hudson River.—Ira A. Place has been appointed General Counsel. Albert H. Harris has been appointed General Attorney, succeeding Mr. Place.

The headquarters of W. C. Brown, Vice-President, in charge of Operating Department, have been transferred from New York to Chicago (La Salle Street Station).

The general western passenger agency at Chicago has been abolished.

See New York & Ottawa.

See Rutland.

New York, Ontario & Western.—Willis D. McQueen has been appointed Superintendent of the Scranton Division, succeeding R. B. Williams, resigned. Mr. McQueen has been Car Accountant for the past 12 years.

Northern Central.—See Pennsylvania.

Northern Pacific.—R. E. Palmer has been appointed Assistant General Superintendent, with headquarters at Tacoma, succeeding A. E. Law, resigned. Mr. Palmer has been Superintendent of the Rocky Mountain Division since 1891. Andrew Gibson, Superintendent of the Yellowstone Division, has been transferred as Superintendent to the Rocky Mountain Division, and J. M. Rapelje, who has been Trainmaster of the Yellowstone Division, has been made Superintendent.

Howard Curry has been appointed General Master Mechanic, with headquarters at St. Paul, succeeding A. W. Wheatley.

Northern Securities.—At the annual meeting Amos Tuck French was elected a director, succeeding E. H. Harriman.

Oregon & Eureka.—W. W. Peed has been appointed Acting Superintendent, with headquarters at Eureka, Cal., succeeding C. W. Root, previously Superintendent.

Oregon Railroad & Navigation.—B. A. Worthington, General Manager, has been elected Vice-President.

Pennsylvania.—L. R. Zollinger has been appointed Engineer of Maintenance of Way of the Northern Central, Philadelphia, Baltimore & Washington, and West Jersey & Seashore, as well as of the Pennsylvania.

See Pennsylvania, New York & Long Island.

Pennsylvania Lines West.—J. M. Chesbrough Assistant General Passenger Agent and General Passenger Agent of the Vandalia, has been appointed General Passenger Agent at St. Louis.

Pennsylvania Lines West (Southwest System).—R. A. McCarty, Superintendent of the Pittsburg Division, has been appointed General Superintendent, succeeding Ralph Peters, now President of the Long Island. P. A. Bonebrake, Superintendent of the Logansport division of the Pittsburg, Cincinnati, Chicago & St. Louis, has been transferred to the Pittsburg division, succeeding R. E. McCarty, promoted to be General Superintendent of the Southwest System. Mr. Bonebrake is succeeded by J. W. Coneys, Superintendent of the Marietta division of the Northwest System.

Pennsylvania, New York & Long Island.—W. W. Atterbury, General Manager of the Pennsylvania, has been appointed General Manager of this company. Lewis T. Ford, who has been Superintendent of the Pennsylvania at Oil City, Pa., has been appointed Superintendent, with office at New York.

Pere Marquette.—Richard N. Young has been elected Vice-President, with office at New York. I. L. Carroll has been elected Secretary and Treasurer, with office at New York, succeeding Charles Merriam.

Philadelphia & Reading.—The position of Master Mechanic on the Reading and Lebanon divisions has been abolished, and C. W. Allen has been appointed Motive Power Foreman of those divisions, with headquarters at Reading.

Philadelphia, Baltimore & Washington.—See Pennsylvania.

Pittsburg & Lake Erie.—Chas. L. Gist, Superintendent of Transportation, has died. The position of Superintendent of Transportation has been abolished and that of Super-

intendent of Car Service established, to which N. K. Hoffman has been appointed.

Pullman Company.—A. A. Cummins, who has been Acting Auditor of Disbursements, has been appointed Auditor of Disbursements.

Rahway Valley (formerly New Orange Four Junction).—Louis Keller has been elected Vice-President of this road, with office at New York, succeeding Denis Long. James S. Gilbert has been elected Treasurer, with office at New York, succeeding J. B. Rathbone.

Rio Grande, Sierra Madre & Pacific.—John H. Martin has been elected Secretary and Assistant Treasurer, and R. A. Jones, Assistant Secretary, both with offices at New York. J. P. Hallihan has been appointed Chief Engineer and Assistant to the President, with office at El Paso, Tex. E. J. Craig has been appointed Purchasing Agent.

See Chicago, Peoria & St. Louis of Illinois.

Rutland.—The authorities of F. E. Herriman, General Coal Agent, and H. W. Henry, Assistant General Coal Agent, have been extended over this road.

The Freight Claims Department has been transferred to the Accounting Department.

St. Louis & San Francisco.—T. J. Franks has been appointed General Agent, Operating Department, with headquarters at St. Louis. He will be in charge of the company's mails and of its relations with the United States postal department. O. M. Conley has been appointed Assistant General Freight Agent, with headquarters at St. Louis, succeeding Mr. Franks.

San Antonio & Aransas Pass.—George F. Lupton has been appointed General Passenger Agent.

San Pedro, Los Angeles & Salt Lake.—C. O. Whittemore has been appointed Assistant Secretary, with office at Salt Lake City. The office of R. E. Wells, General Manager, has been removed from Salt Lake City to Los Angeles, Cal. E. G. Tilton, previously Acting Chief Engineer, has been appointed Chief Engineer. The title of W. C. Hussey has been changed from General Claim Agent to Claim Agent. The office of F. F. Clayton, Car Accountant, has been removed from Salt Lake City to Los Angeles.

B. M. Garfield has been appointed General Passenger Agent.

Savannah & Statesboro.—H. B. Grimshaw has been appointed Superintendent and in addition to having charge of operation, will take charge of all matters connected with car mileage. All communications relating to such subjects should be addressed to him at Statesboro.

Shreveport, Alexandria & Southwestern.—R. Jemeson has been appointed Auditor of the Louisiana & Pacific Division, with headquarters at Bon Ami, La., succeeding R. H. Mathis, resigned.

Southern Pacific.—W. B. Scott, Vice-President and General Manager of the Houston, East & West Texas and Houston & Shreveport, and General Superintendent of the Houston & Texas Central, has been appointed Assistant Director of Maintenance and Operation of the Southern Pacific, and allied lines, with offices at Chicago, effective May 1.

H. P. Thrall has been appointed Agent of Mail Service of Morgan's Louisiana & Texas Railroad; Louisiana Western; Galveston, Harrisburg & San Antonio; Texas & New Orleans; Galveston, Houston & Northern; New York, Texas & Mexican; Gulf, Western Texas & Pacific; Houston & Texas Central; Houston, East & West Texas and Houston and Shreveport.

Spokane Falls & Northern.—A. Nugent has been appointed Master Mechanic, with office at Spokane, Wash.

Tacoma Eastern.—J. G. Dickson, who has been Auditor and Assistant Secretary, has been appointed Auditor and General Freight and Passenger Agent. H. F. Weatherby has been appointed Master Mechanic, with headquarters at Bismarck, Wash., succeeding Robert Bagley.

Temiskaming & Northern Ontario.—George A. McCarthy, who has been Assistant Engineer of the Canadian Niagara Falls Power Company, has been appointed Engineer of Maintenance of Way and Assistant to the Chief Engineer.

Toledo, St. Louis & Western.—Walter L. Ross, heretofore General Passenger Agent, has been appointed General Freight and Passenger Agent.

Vandalia.—The first directors of this consolidated company have been elected as follows: W. K. Donaldson, St. Louis; Charles B. Seyht, Highland, Ill.; J. J. Brooks, Pittsburg, and John G. Williams, Indianapolis, terms to expire April, 1906; J. J. Turner, Pittsburg; Edward B. Taylor, Pittsburg; Samuel Rea, Philadelphia and V. T. Malott, Indianapolis, terms to expire April, 1907; James McCrea, Pittsburg; Joseph Wood, Pittsburg and John P. Green, Philadelphia, terms to expire April, 1908.

Union Pacific.—H. C. Ferris, Superintendent of the Colorado Division, with headquarters at Denver, has been transferred to Omaha, succeeding W. A. Deuel. See Denver, Northwestern & Pacific.

Western Allegheny.—R. G. Hengst has been appointed Assistant Chief Engineer, with headquarters at New Castle, Pa.

Western Maryland.—George M. Curtis has been appointed Freight Auditor of this company and of the West Virginia Central & Pittsburg, with office at Baltimore, Md., succeeding James H. Price, assigned to other duties.

West Jersey & Seashore.—See Pennsylvania.

West Side Belt.—T. P. Bodell, Superintendent of Bridges and Buildings of the Wheeling & Lake Erie, with headquarters at Canton, Ohio, has been appointed to the same position on this road.

West Virginia Central & Pittsburg.—See Western Maryland.

Wheeling & Lake Erie.—The general passenger and ticket department has been transferred to St. Louis, Mo.

See West Side Belt.

Yazoo & Mississippi Valley.—H. R. Safford, Assistant Chief Engineer of the Illinois Central, has been appointed Assistant Chief Engineer of this company. M. Welsh has been appointed Chief Special Agent, succeeding J. J. Howe, previously Acting Chief Special Agent, transferred; both with offices at Chicago, Ill.

LOCOMOTIVE BUILDING.

The Atchison, Topeka & Santa Fe is reported to have ordered 40 switching locomotives from the Baldwin Works.

The Chicago Southern has ordered eight locomotives from the Rogers Works of the American Locomotive Company.

The Chesapeake & Ohio has ordered 18 consolidation (2-8-0) freight locomotives from the American Locomotive Company.

The Detroit Southern has ordered 30 consolidation (2-8-0) freight locomotives, with cylinders 19½ in. x 28 in., from the American Locomotive Co.

The Illinois Central has ordered 25 consolidation (2-8-0) locomotives and 10 switching (0-6-0) locomotives from the American Locomotive Company.

The Chicago, Rock Island & Pacific has ordered or will order during 1905, 115 locomotives, including 32 passenger locomotives, 53 freight locomotives and 30 switching locomotives.

The Chicago, St. Paul, Minneapolis & Omaha is reported to have ordered two locomotives from the Schenectady Works of the American Locomotive Company.

The Canadian Pacific, as reported in our issue of March 17, will build 10 ten-wheel (4-6-0) locomotives at its Angus shops. These locomotives will have the same specifications as the 40 locomotives ordered—30 from the Montreal Locomotive Company, and 10 from the Canadian Locomotive Company, reported in our issue of Feb. 3. All 50 of the locomotives are for June, July and August delivery.

The Minneapolis, St. Paul & Sault Ste. Marie, as reported in our issue of April 7, has ordered six mogul (2-6-0) locomotives from the Schenectady Works of the American Locomotive Co. These locomotives are to weigh 148,000 lbs., with 125,000 lbs. on drivers; cylinders, 21 in. x 32½ in.; stroke of piston, 26 in.; diameter of drivers, 55 in.; extended wagon-top boiler, with a working steam pressure of 200 lbs.; total heating surface, 1,847.6 sq. ft.; 266 charcoal iron tubes, 2 in. in diameter and 12 ft. 4 in. long; firebox, 90⅛ in. x 62¼ in.; grate area, 38.96 sq. ft.; tank capacity, 6,000 gallons, and coal capacity, 10 tons. The special equipment will include Westinghouse air-brakes and Washburn couplers.

The Grand Rapids & Indiana, as reported in our issue of April 7, has ordered 10 simple consolidation (2-8-0) locomotives from the American Locomotive Co., for September delivery. These locomotives are to weigh 175,000 lbs., with 155,000 lbs. on drivers; cylinders, 21 in. x 28 in.; diameter of drivers, 56 in.; Belpaire boiler with a working steam pressure of 200 lbs.; heating surface, 2,600 sq. ft.; 320 National Tube Co.'s tubes, 2 in. in diameter and 14 ft. 8 in. long; Pennsylvania Railroad specification wide fire-box, 103 in. long and 66 in. wide; grate area, 45 sq. ft.; tank capacity, 6,000 gallons and coal capacity, 12 tons. The special equipment will include Westinghouse American air brakes, Pennsylvania Railroad specification axles and journal bearings, "Little Giant" bell ringers, Keasby and Mattison magnesia boiler lagging, National hollow brake beams, American Steel Foundry's brake shoes and wheel centers, Kelso couplers, Star headlights, Nathan and Sellers' injectors, United States and Jerome piston and valve rod packings, Kunkle safety valves, Leach sanding devices, Nathan sight-feed lubricators, Union Spring Company's springs, Crosby steam gages and Latrobe driving and truck wheel tires.

The Central of Georgia, as reported in our issue of March 31, has ordered five simple Pacific type (4-6-2) locomotives from the Baldwin Works for April delivery. These locomotives are to weigh 190,000 lbs., with 123,000 lbs. on drivers, 35,000 lbs. on front trucks and 32,000 lbs. on trailers; tractive power, 30,870 lbs.; cylinders, 21 in. x 28 in.; diameter of drivers, 66 in.; straight boiler, with a working steam pressure of 200 lbs.; heating surface, 3,244 sq. ft.; firebox, 166 sq. ft.; total heating surface, 3,410 sq. ft.; 285 iron tubes, 2¼ in. in diameter and 19 ft. 5 in. long; wide firebox, 102 in. x 66 in.; grate area, 46¾ sq. ft., and tank capacity, 6,000 gal. The special equipment will include: Westinghouse American high speed air brakes, train signal and attachments, Central of Georgia standard axles and springs, Golmar air bell ringer, sectional magnesia boiler lagging, Diamond special brake beams, Tower couplers, Pyle National electric headlights, Nathan Simplex (No. 10) injectors, Phillips double boiler checks, Ajax metal journal bearings, United States multi-angular piston and valve rod packings, Coale safety valves, Leach ("A") sanding devices, Nathan bull's-eye sight feed lubricators, Ashcroft steam gages, Central of Georgia standard driving wheel tires and steel-tired truck and tender wheel tires, cast-steel spoked wheel centers, cast-steel steam chests and cylinder heads, steel tender frames, cast-steel

truck bolsters, Symington journal boxes and dust guards and Westinghouse friction draft gear.

CAR BUILDING.

The Missouri Pacific has ordered 300 Hart Convertible cars from the Rodger Ballast Car Co.

The Denver & Rio Grande is reported to be building a number of open top observation cars.

The Missouri, Kansas & Texas has ordered 55 Hart Convertible cars from the Rodger Ballast Car Co.

The Merchants' Despatch Transportation Company is reported to be building 850 refrigerator cars:

The Chesapeake & Ohio has ordered 1,500 gondolas of 100,000 lbs. capacity, from the Pressed Steel Car Company.

The Ligonier Valley has ordered 16 hopper bottom coal cars of 50,000 lbs. capacity from A. V. Kaiser & Co., of Philadelphia.

The Rodger Ballast Car Company has ordered 10 freight cars from the West Detroit Works of the American Car & Foundry Co.

The Maine Central is reported to have ordered 40 freight cars from the Detroit Works of the American Car & Foundry Company.

The Cleveland, Cincinnati, Chicago & St. Louis has ordered 200 Hart Convertible ballast, coal and gondola cars, from the Rodger Ballast Car Co.

The Chicago, Rock Island & Pacific has ordered or will order during 1905, 33 cars for passenger equipment, and 4,321 cars for freight equipment.

The Detroit Southern has ordered 500 box cars from Barney & Smith, and 1,800 coal cars, 2,000 gondolas and 200 flat cars from the American Car & Foundry Co.

The Mineral Range has ordered 50 hopper bottom coal and ore cars of 80,000 lbs. capacity from the American Car & Foundry Co., for June delivery. These cars will be 32 ft. long over end sills, 8 ft. 9 in. wide and 8 ft. 4 in. high. The special equipment will include: Common Sense bolsters, Monarch brake beams, American Car & Foundry Co.'s brake shoes and wheels, Westinghouse air-brakes, National-Fulton brasses, Janney couplers, Gould draft rigging, Symington dust guards, journal boxes and lids, Railway Steel Spring Co.'s springs and Diamond arch-bar trucks.

The Lake Superior & Ishpeming, as reported in our issue of April 7, has ordered 150 steel hopper ore cars of 110,000 lbs. capacity from the Pittsburg Works of the Pressed Steel Car Co., for May delivery: 125 of these are for the Lake Superior & Ishpeming and 25 for the Marquette & Southeastern. These cars are to weigh 31,500 lbs., and measure 24 ft. long, 8 ft. wide and 9 ft. 9 in. high over all. The special equipment is to include Pressed Steel Car Company's bolsters and brake-beams, and Pittsburg Brake-Shoe Company's brake-shoes; Westinghouse air-brakes, Tower (5 in. x 7 in.) couplers, Westinghouse friction draft rigging, and McCord journal boxes.

The Chicago City Railway, as reported in our issue of April 7, has ordered 200 semi-convertible cars from the J. G. Brill Co., for June 1 delivery. These cars are to weigh 46,000 lbs. and have 44 seats. They will measure 34 ft. long, 8 ft. wide and 8 ft. 1 in. high, inside measurements, and 46 ft. 6 in. long, 9 ft. wide and 11 ft. 10 in. high, over all, with wooden frames and combination wood and metal underframes. The special equipment will include: McGuire-Cummings axles, bolsters, brake-beams, brake-shoes, brasses, couplers, springs, trucks and cast-iron wheels, National Electric Co.'s brakes, Curtain Supply Company's curtain fixtures, Pantasote curtain material, J. G. Brill Company's door fastenings, doors, draft rigging, dust guards, platforms and roofs, Consolidated Electric Company's heating system, Chicago City Ry. standard journal boxes, and General Electric Company's lighting system. The make of paint is to be selected by the car builder.

The Central Vermont, as reported in our issue of April 7, has ordered four first class passenger coaches, two smoking cars and two cafe parlor cars from the Wilmington Works of the American Car & Foundry Co., for June 1 delivery. The coaches are to have a seating capacity of 72 persons, the smoking cars of 84 persons, and the parlor cars of 32 persons. All cars are to measure 73 ft. long, 8 ft. 10 in. wide and 9 ft. 8 in. high, inside measurements, and 74 ft. long, 9 ft. 8 in. wide and 14 ft. high, over all, with wooden frames and underframes. The special equipment will include: Composite bolsters, Diamond special brake-beams, Chrystie brake-shoes, Westinghouse triple air-brakes, Central Vermont standard brasses, Tower couplers, Burrows curtain fixtures, Pantasote curtain material, panel doors, Miner draft rigging, Consolidated heating system, Pintsch gas, Central Vermont standard paint, National steel platforms, canvas roofs, Heywood Bros. & Wakefield Co.'s walk-over seats, elliptic springs, six-wheel iron-cased trucks, Pullman vestibules, and steel tired wheels with Midvale tires and cast-iron centers. The coaches and parlor-cafe cars are to have smoking compartments.

BRIDGE BUILDING.

BELMONT, MAN.—The Government has been petitioned by the Town Council to build a steel bridge over the Pembina river at this place.

CINCINNATI, OHIO.—Bids are wanted May 5, by the Board of County Commissioners, for the steel superstructure of the elevated bridge over the Miami and Erie Canal at Lockland in Hamilton County. Eugene L. Lewis is County Auditor.

DECATUR, ALA.—Residents of the various counties are arranging to build a combined highway and electric railroad bridge over the Tennessee River under the direction of the Business Men's League of Decatur, which has permission from the United States Government to build a bridge to cost about $225,000 over the Tennessee River.

EAST TORONTO, ONT.—A plan is under way to widen the Main street bridge at a cost of about $18,000.

ERLANGER, KY.—The Cincinnati, New Orleans & Texas Pacific, it is reported, has given a contract to the American Bridge Co. for building a new double-deck steel bridge here to replace the present structure.

GREENOCK, ONT.—A new steel bridge will be built at this place.

JACKSON, MISS.—The City Council will soon ask for $30,000 of bridge bonds for building a bridge on Rankin street.

LONDON, ONT.—The Middlesex County Council has decided to build a bridge over the Thames at Putnam, for which plans are being made by the County Engineer.

LOS ANGELES, CAL.—A viaduct is proposed to be built over the Los Angeles river at Seventh street, to replace the structure recently carried away by high water.

MANISTEE, MICH.—Bids, it is reported, for building a bridge at Maple street to replace the present structure were: Modern Steel Structure Co., $36,253; Milwaukee Bridge Co., $36,975; Joliet Bridge & Iron Co., $37,483; Groton Bridge Co., $37,793; Massillon Bridge Co., $38,149; King Bridge Co., $43,297; Huston & Cleveland $44,595; John P. Cowing, $66,595; Scherzer, double leaf, hand, $34,000; Scherzer, double leaf, electric, $36,000; Scherzer, single leaf, hand, $37,000; Scherzer, single leaf, electric, $39,000.

MANITOWOC, WIS.—The Chicago & Northwestern is asking bids for building a trestle of steel about 1,000 ft. long on the Green Bay extension of its road.

MONTREAL, QUE.—At a joint meeting, the City Council and the Harbor Commissioners have decided to build a bridge from Commissioners' street to Ferry Landing, on Victoria pier, at a cost of about $15,000. Harbor Engineer Kennedy will have charge of the work.

NEWARK, N. J.—Plans for widening the plank road 100 ft., which are now under consideration, include the building of a new steel bridge over the Passaic river.

OATES ISLAND, TENN.—The Southern Ry. is planning to build a bridge over the Tennessee river at this place. The work will take about two years to complete.

PORT CLINTON, PA.—The Philadelphia & Reading, it is reported, will build a steel bridge to replace the present structure.

SCRANTON, PA.—Bids are wanted by E. A. Jones, County Comptroller, for building five bridges in Lackawanna County.

WASHINGTON, D. C.—Bids are wanted May 1, at the office of the Commissioners, for the construction of a seven-span steel bridge over the eastern branch of the Potomac river, at the foot of 11th street East. Henry B. F. MacFarland, Henry L. West, John Biddle, Commissioners, D. C.

WATROUS, N. MEX.—The Atchison, Topeka & Santa Fe will, it is reported, in connection with the relocation of its line, build a new bridge 510 ft. long at an elevation of 45 ft .above high water over the Aguamoro River at this place.

WAVERLY, OHIO.—The Norfolk & Western will build a steel bridge on its Columbus division near this place; also one near Chillicothe over Indian Creek.

WINNIPEG, MAN.—This city, together with the municipalities on the opposite side of the Red river and the Winnipeg Street Ry., will jointly build three steel bridges over the river; one at Pembina street, to have a roadway of 20 ft., with 6-ft. sidewalks, to cost $70,000; one at St. Johns avenue, of a similar width, to cost $25,000, and the remaining one at the foot of Market or James street, to be the same width, to cost $138,000.

Other Structures.

ATCHISON, KAN.—The Missouri Pacific shops, local reports state, are to occupy new buildings a mile west and their capacity more than doubled. Plans for new buildings have been made and the land surveyed, and work will be begun in a short time.

AUSTIN, TEX.—The Missouri, Kansas & Texas, it is reported, has bought a site for a freight and passenger terminal.

BRISTOL, TENN.—The Norfolk & Western, it is reported, will put up new repair shops, a new roundhouse and other buildings at this place, to cost about $400,000.

BUTTE, MONT.—The Northern Pacific, reports say, has plans ready for putting up a new passenger station at this place.

CLARKSVILLE, TENN.—The Tennessee Central, local reports state, will begin work at once on a new freight house and remodel the present passenger station.

LITTLE ROCK, ARK.—The St. Louis, Iron Mountain & Southern, it is reported, will make extensive improvements at Baring Cross, including a boiler shop, remodeling the power plant, rebuilding its paint shop recently destroyed by fire, and additional buildings to its planing mill to increase the capacity of its works.

MEXICO CITY, MEX.—The Mexican Southern will put up stone passenger stations at Tres Jagueys, Rosendo, Marquez and Tomellin.

NASHVILLE, TENN.—The Nashville Railway & Light Co., reports say, has bought a site in West Nashville, on which it will put up car shops and machine shops to cost $150,000.

NEW ORLEANS, LA.—The Illinois Central has given a contract to James A. Stewart &

Co., of Chicago, for the wharves and smaller warehouses recently destroyed by fire at the Stuyvesant docks. A contract has also been given to Swift & Co., of Chicago, for the big warehouses and work has already been commenced. Work on the buildings must be completed within three months and on the wharves within five months.

NEW YORK, N. Y.—The New York Central will spend about $200,000 in putting up a temporary brick passenger station between Vanderbilt and Madison avenues, and between Forty-third and Forty-fourth streets, while the new Grand Central station is being built on the old site.

The Pennsylvania, reports say, has given a contract to Norcross Brothers Company, of Worcester, Mass., for the granite to be used in the new passenger station at Seventh avenue.

The New York Central, it is said, is buying land between its right of way and Mott avenue, from 138th to 149th street, in the Bronx, for the site of a passenger station much larger than the present one.

PITTSBURG, PA.—The Wabash freight station at Liberty avenue and Ferry streets was recently damaged by fire.

PORTLAND, ORE.—Excavation work has been commenced for the machine shops of the Oregon Railroad & Navigation Co., to cost about $200,000.

SCHENECTADY, N. Y.—The proposed union passenger station, which will be built jointly by the New York Central and other roads, will cost in the neighborhood of $300,000.

TERRE HAUTE, IND.—The Vandalia is planning to spend a large amount of money in improvements, to include additions to its shops at this place.

TYLER, TEX.—The St. Louis Southwestern will soon put up a brick and stone passenger station to cost about $18,000, and build additions to its freight depot.

WACO, TEX.—The St. Louis Southwestern, it is reported, will soon begin work on a new brick passenger station to cost about $75,000.

WAYCROSS, GA.—Announcement has been made that the Atlantic Coast Line will build shops and make other improvements at this place to cost about $400,000.

WINNIPEG, MAN.—A contract has been given by the Canadian Pacific to A. E. & Roy Barrett Co., of Seattle, to build a large tourist hotel on the line of its road west of Winnipeg to cost about $500,000. Work will be commenced at once, the foundation having already been completed.

RAILROAD CONSTRUCTION.

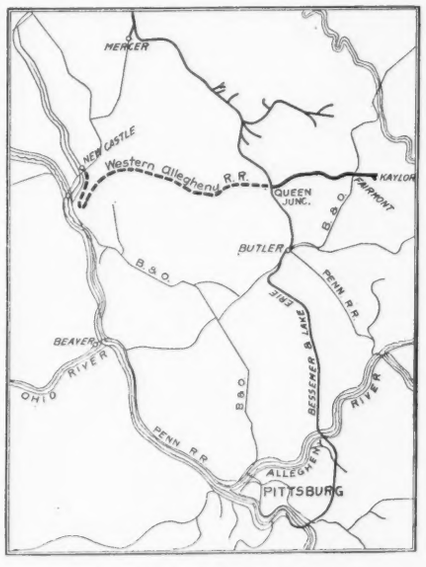
New Incorporations, Surveys, Etc.

APALACHICOLA & NORTHERN.—A charter was granted this company last year in Florida and construction work will soon be commenced on that section of the road between Apalachicola and Quincy. The proposed route is from Apalachicola to Quincy, Fla., where it will cross the Seaboard Air Line, and thence to Bainbridge, Ga., which will be the northern terminus for the present, a distance of about 80 miles. R. B. Coleman, of Bainbridge, is Superintendent of Construction.

ARKANSAS CENTRAL.—This company, which operates a line between Fort Smith and Paris, Ark., 45 miles, is making surveys to extend its line from Paris to Dardanelle, about 60 miles. It is said that rights of way are being secured, and that contracts for the work will soon be let.

BROOKLYN RAPID TRANSIT.—The plans for changing the tracks of the Long Island R. R. and of the Brighton Beach branch of the Brooklyn Rapid Transit Co., in the Borough of Brooklyn, N. Y., have been approved by the Department of Public Works, and the Brooklyn Grade Crossing Commission, which has the improvements in charge, under a special law, will soon have contracts prepared and advertise for bids for the work which is to be commenced this spring. It will cost in the neighborhood of $7,000,000. The plans call for a cut from 18 ft. to 20 ft. deep on the Manhattan Division of the Long Island from Manhattan Junction to Bay Ridge, where there will be a large depressed freight terminal.

BESSEMER & LAKE ERIE.—An officer writes that the first section of the New Castle extension of the Western Allegheny from Queen Junction to Isle P. O., 6.7 miles, will be built by the company's forces. A contract for building the road from Isle P. O. to the west side of Slippery Rock Creek, a little over eight miles, has been let to Thomas & Villelli, of Pittsburg, and for the balance from the latter place to New Castle to F. A. Maselli & Co., of Pittsburg. The operating grade westbound will be 0.3 per cent., and eastbound 0.5 per cent. for the first 14 miles out of New Castle, and 0.3 per cent. from there to Queen Junction. The sharpest temporary curves will be 8 deg., which will be eliminated at some future time. The entire line will be laid with 85-lb. rails. A steel viaduct will be built 10 miles east of New Castle over Slippery Rock Creek, 560 ft. long and 98 ft. from the base of the rail to the bed of the creek. Contracts for the foundation of this viaduct have been let to Thomas & Villelli, of Pittsburg, and for the superstructure to the American Bridge Co. H. T. Porter, of Greenville, Pa., is Chief Engineer of the Western Allegheny.



Bessemer & Lake Erie.

BUFFALO & SUSQUEHANNA.—The Susquehanna & Southern has been extended from Medix Run, Pa., southward to DuBois, 26 miles.

BUFFALO, ROCHESTER & PITTSBURG.—A contract is reported let by this company to S. A. Rinn, of Punxsutawney, for building five miles of second track which, when completed, will give a double track all the way from that place to Buffalo.

CANADIAN NORTHERN.—The line between Arizona Junction, Manitoba and Carberry Junction, Manitoba, via Carberry, 74 miles, has been opened for business. The main line has been extended from Kamsack, Assiniboia, westward to Humboldt, 146 miles.

The Railway Committee has passed the bill authorizing this company to build from a point near Regina to a point near or on the Red Deer river, in the district of Alberta, with a branch west of the Saskatchewan river, and thence to Township 45, Range 4, west of the third meridian; also from a point on the Canadian Northern between Humboldt and the South Saskatchewan river to a point near the crossing of the South Saskatchewan by the Prince Albert Branch of the Canadian Pacific; also from Regina to Humboldt, thence down the Carrot to Pas Mission, also from the C. N. west of Battleford into the town of Battleford, has been passed by the Railway Committee.

CANADIAN PACIFIC.—The railway department, it is reported, has given permission to this company to build a branch line from Wolseley, N. W. T., on the main line southeast between Moose mountain and the Pipestone river, to Reston, about 119 miles.

Reports from Montreal state that an officer of this road has announced the following work to be carried out during the present summer: Extension of the Teulon or Winnipeg Beach branch northward to Icelandic river, 32 miles, of which one-half will be built this year. Twenty-five miles will be built east and 25 miles west of Saskatoon, and an extension will also be built from the northwest section south of the Quill lakes; the completion of the Kirkella Line to Mile 202; the extension of the Wetaskwin and Lacombe sections, 50 miles each, and probably a line from Yank, B. C., to the boundary.

CHICAGO, BURLINGTON & QUINCY.—A contract is reported let to J. Jolly, for the extension of the company's new line from Frannie, on the Toluca-Cody branch, to the Shoshone reservation, the contract including the grade construction from Frannie through Lovell and Basin as far as Thermopolis. This is the line which the Burlington, under the name of the Big Horn Railroad, will build to the Wind River reservation.

CHICAGO, ROCK ISLAND & PACIFIC.—An officer writes that this company is planning expenditures during the present year as follows:

	Maintenance.	Betterments.	Total.
Roadway	$4,671,307	$1,364,341	$6,035,648
Bridges	1,125,404	530,013	1,655,417
Buildings	603,684	59,431	663,115
Miscellaneous*	731,472	7,953	739,425
Total	$7,131,867	$1,961,738	$9,093,605

*Roadway and structure.

This includes estimates for rebuilding 39 bridges on the main line, Chicago to Colorado; 16 on line between Burlington and St. Paul and branches, and 54 in Missouri, Kansas and the southwest, also for passenger stations at North Fort Worth, Texas; Pella, Iowa, and an employees' hotel at East Moline shops.

CINCINNATI & MUSKINGUM VALLEY.—This company is planning to lay six miles of track at Roseville, Ohio, to increase the capacity of its yards, at a cost of about $30,000.

CINCINNATI, HAMILTON & DAYTON.—According to reports, line will be reballasted from Cincinnati to Toledo. The company intends to immediately relay 160 miles of track on that division with 85-lb. rails.

COLORADO & SOUTHERN.—An extension of this road is planned to complete a through line from Denver to Galveston in connection with the Fort Worth & Denver City. The plan includes the buying of the Trinity & Brazos Valley, 80 miles, and the construction of 160 miles of new road. The contracts for this are reported let, and the cost, it is said, will be about $8,000,000.

DENVER, NORTHWESTERN & PACIFIC.—An officer is reported as saying that funds have been secured for at once continuing the construction of this road to Salt Lake, and that contracts will soon be let for the work.

DES MOINES INTERURBAN (ELECTRIC).—Announcement has been made by this company that it will build a new line from Westover, a suburb of Des Moines, to Woodward, Iowa, 23 miles, with a branch from a point about four miles south of Woodward to Perry, Iowa, nine miles, at a cost of about $1,000,000. H. H. Polk is President.

EL PASO, MOUNTAIN PARK & ST. LOUIS.—This company, which proposes to build from Joplin, Mo., to Quanah, Texas, is securing rights of way through Oklahoma City.

GEORGIA, FLORIDA & ALABAMA.—Work is to be started at once on an extension of this road from Cuthbert, Ga., to Benevolence, Ga., 10 miles. From the latter point the company is planning to build either to Richmond or to Columbus, Ga., via Lumpkin.

GEORGIA RAILROAD.—According to reports,

this company will rebuild a section of its main line between Belair and Grovetown, which will straighten about five miles of curved line.

GULFPORT & MISSISSIPPI COAST.—Application will be made in Mississippi for a charter by a company under this name, with a capital of $1,000,000, to build an electric road. J. T. Jones, E. A. Durham, Robert McComico and others are interested. The headquarters of the company will be at Gulfport.

ILLINOIS CENTRAL.—This company has filed articles of incorporation for an extension of its line from Shawneetown to Golconda, Ill., 30 miles; a branch is also planned from the Fairview mine, in Harbin County, to the Ohio river.

Surveys, it is reported, are being made by this company in Vermilion County, Ill., and western Indiana for an extension south from Kankakee, Ill., connecting with the Lake Erie & Western near Rankin.

INDIANAPOLIS & CHICAGO AIR LINE (ELECTRIC).—An officer writes that this company, which has been organized in Illinois, is to build an electric road from Indianapolis to Chicago, and will let contracts for the work about the first of June. The total length of the road will be 175 miles, with a maximum grade of 1 per cent., and the work will necessitate the building of six steel bridges. C. Knowlton is General Manager, 305 Terminal Station Bldg., Indianapolis, Ind.

IOWA VALLEY INTERURBAN (ELECTRIC).—This company is seeking incorporation in Benton County, Iowa, with a capital of $100,000, to build from Belle Plaine to Vinton, about 28 miles. The necessary franchises have been secured and ratified. Two surveys have been made. One through Keystone and Garrison, the other running about two miles east of Keystone. This does not touch Garrison, but is three miles shorter than the other route. The office of the company will be at Belle Plaine. Geo. W. Voss is President; Thos. F. Murray, Vice-President; W. A. Mall, Treasurer, and H. R. Mosnat, Secretary and General Manager.

KANSAS, MEDICINE VALLEY & WESTERN.—A charter has been granted this company in Kansas, with a capital of $500,000, to build a line from the Kansas oil fields to Trinidad, Colo., about 960 miles. The proposed route is from Independence, Kan., through Montgomery, Chautauqua, Elk, Cowley, Sumner, Harper, Barber, Pratt, Comanche, Kiowa, Clark Ford, Gray, Haskell, Grant, Stanton, Stevens and Morton counties, Kansas, to Trinidad, Colo. It is to be a coal road. Surveyors are locating the line between Anthony and Medicine Lodge. The incorporators are: T. A. Noftzger, F. D. Brooks, F. C. Firestone, M. D. Hoopes, Joseph Thompson and P. G. Walton, of Anthony, Kan.

LAKE ERIE & SOUTHERN.—This company, which proposes to build a new line from Lorain, Ohio, via Grafton to Wellington, has secured rights of way for the entire line, it is reported. The proposed route extends from the harbor of Lorain, along which the company has 5,000 ft. of dock space and land for terminal purposes, past the steam works in South Lorain to Grafton and thence to Wellington.

LITTLE ROCK & HOT SPRINGS (ELECTRIC).—An officer writes that this company, which proposes to build an electric road from Little Rock southwest to Hot Springs, will start work in a short time and will soon ask for bids for the work.

LONG ISLAND.—See Brooklyn Rapid Transit.

MEXICAN ROADS.—A concession, it is reported, has been given to Sidney A. Witherbee and others, of Chicago, to build a narrow-gage road from San Juan de las Huertas to Puente de Ixtle, 56 miles. A narrow-gage road running from the former place to Toluca, 16 miles, is to be bought for a connecting link. The road will eventually be extended to Acapulco, 144 miles.

MISSOURI, ARKANSAS & SOUTHERN.—A charter has been granted this company in Arkansas to build a road from the Arkansas state line through Green, Lawrence, Sharp and Independence Counties to Batesville, 70 miles. The directors are: Robert W. Earnhart, N. E. Duffy, Lyman F. Reeder and others.

MUNCIE, HARTFORD & FORT WAYNE (ELECTRIC).—This company, which operates an electric road from Muncie, Ind., to Bluffton, has filed a mortgage for $1,000,000 in favor of the Guardian Savings & Trust Co., of Cleveland, Ohio. The money raised by this mortgage will be used to extend the line north from Bluffton to Fort Wayne, 28 miles. The work will be completed during the coming summer.

NEVADA & CALIFORNIA (SOUTHERN PACIFIC).—Articles of incorporation have been filed by this company in California, with a capital stock of $15,000,000, to build a line from Hazen, Churchill County, Nev., southward to a point on the Mojave desert, and a branch line 27 miles long from Churchill, on the Carson & Colorado, to Mound House Station, on the Virginia & Truckee.

NORFOLK & WESTERN.—The Big Stony Ry., which was recently bought by this company, will, it is reported, be extended up Big Stony Creek through Giles County, over the Divide and down the valley of Potts creek in Monroe County, and will eventually be extended to a terminus at Covington, Va., on the Chesapeake & Ohio.

NORTHERN CENTRAL (PENNSYLVANIA).—The directors of this company have authorized the expenditure of about $1,500,000 during the present year, as follows: For additional tracks from New Cumberland to Fairview, including a new line at Bridgeport, $389,000; extension of the fourth track from Wago to Falls Yard, $289,000, and additional track in Fairview, $240,000; extension of third and fourth tracks from Mt. Royal Junction to Mt. Vernon, on the Baltimore Division, $35,000, and other improvements to cost about $41,000.

OAXACA RAILROAD.—Application has been made to the Mexican Government by W. G. Seaver, of New York, for a concession to build a road to cost $37,000,000 from Mexico City to Merida, with a branch line to Belize, British Honduras. According to the report, the promoters have secured from New York capitalists funds necessary to complete this work, and have not asked for a subsidy from the Mexican Government. Colonel James McNaught, First Vice-President of the Great Northern of Canada, it is said, will be the President of the road, and W. I. Allen, formerly General Manager of the Rock Island, will be General Manager.

OREGON & SOUTHEASTERN.—This company has been incorporated in Portland, Ore., with a capital stock of $1,000,000. The incorporators include Gustave B. Hengen, Ossian F. Paxton and Nathan D. Simon.

PHILADELPHIA, BALTIMORE & WASHINGTON (PENNSYLVANIA).—The board of directors, at a recent meeting, authorized an expenditure of $10,000,000 during the present year. The principal items are for elevation and new construction on the line into Washington, the elevation through Wilmington, and the completion of the bridge at Havre de Grace. There will also be improvements and sidings along the road, and much new equipment.

PENNSYLVANIA LINES WEST.—Contracts will shortly be awarded for work on the Pittsburg Division (Southwest System) for the construction of a third track between Burgettstown and Bulger, about three miles. The work necessitates a large amount of excavation and change of alinement of all the main tracks, bringing the cost up to the neighborhood of $500,000. Several bad curves are to be eliminated, also tunnel No. 3.

Contract has been given to the Kerbaugh Construction Company, of Philadelphia, for completing the track work of the Fort Wayne through Allegheny, from a point near Marion avenue to Island avenue. Tracks are to be depressed and will pass beneath the crossings at North avenue, Pennsylvania avenue and Washington street. The work will cost in the neighborhood of $1,000,000.

RALEIGH & CAPE FEAR.—An officer writes that this company will build an extension from Lillington, the present southern terminus, to Fayetteville, 30 miles. The exact route has not yet been decided upon. The contract for grading has been let to W. J. Bradshaw, work to be commenced at once. The work necessitates the building of three steel bridges, the largest of which will be 500 ft. long, with trestle approaches, of from 1,000 to 1,500 ft., over the Cape Fear River at Lillington, for which contract has been let to the Virginia Bridge & Iron Company, of Roanoke, Va. Contracts for the other two bridges, which are much smaller, have not yet been let.

ST. LOUIS, IRON MOUNTAIN & SOUTHERN.—The State Board of Railway Incorporation has granted permission to this road to build a branch from Eudora, Ark., south through Carroll and Franklin, La., to Gilbert, 76 miles. The cost of the proposed line will be about $1,140,000.

SOUTH BEND & SOUTHERN MICHIGAN (ELECTRIC).—A contract is reported let by this company to Geo. Townsend, of Indianapolis, for building the Benton Harbor Division from Niles, via Berrien Springs, to St. Joseph, at a cost of about $500,000. Rights of way are now being secured and it is expected that the road will be in operation by the first of next year.

SOUTHERN.—Arrangements are being made to let contracts for an extension to be built from Chattanooga, Tenn., to Stevenson, Ala. The work includes a tunnel through Lookout Mountain, which will cost about $3,000,000, and a steel bridge over Tennessee river at Oates Island, eight miles west of Chattanooga.

SOUTHERN INDIANA.—Maps have been filed by this company for the proposed extension from Terre Haute to Indianapolis, 73 miles, on which work is to be commenced next month.

TOLEDO, FOSTORIA & FINDLAY (ELECTRIC).—A contract is reported let to Cresswell & Kleinman, of Findlay, for the grading of the extension of this road from Fostoria to Pemberville, 17 miles, and work will be started at once. The contract calls for track laying within 60 days. The completion of this extension will give the T. F. & F. an entrance into Toledo over the Lake Shore Electric, connection being made between Pemberville and Woodville over the Lake Erie, Bowling Green & Napoleon.

TOLEDO, MARSHALL & NORTHERN.—It is reported that during the coming summer this company proposes to build from Montpelier, Ohio, north to some point on Lake Michigan about 100 miles.

TOLEDO, PORT CLINTON & LAKESIDE (ELECTRIC).—Announcement has been made that this company is letting contracts for the rails, also for the overhead equipment for the extension from the present terminus of the line at Port Clinton to Lakeside, 11 miles. P. McCrory is President.

VIRGINIA & KENTUCKY.—An officer writes that surveys are yet to be made for the proposed extension along Birchfield creek to Clintwood, Va., and that the question of building will depend on the results of the survey; on whether this route is practicable. F. M. McClure, Wise, Va., is Superintendent.

WABASH.—This company, it is reported, has secured an entrance into Lorain, Ohio, through the purchase of rights owned by the Industrial Railway Co. in Lorain. A branch line will be built from the line of the Wheeling & Lake Erie to a point near Wellington. Surveys have been completed.

WARREN & DE VALL'S BLUFF.—This company has been incorporated in Arkansas, with a capital of $1,000,000, to build a road from Warren through Bradley, Cleveland, Jefferson, Lonoke and Prairie counties, to De Vall's Bluff, 90 miles. The incorporators include W. T. Thompson, J. G. Thweat, W. R. Watson, N. McLeod, H. D. Maxwell and others.

WATERTOWN TRANSPORTATION CO.—An of-

ficer writes that this company is planning to build a standard gage steam road from Watertown, S. Dak., west to Lake Kampeska, five miles. The work will be light with no heavy grades. Contracts for building have not yet been let. C. H. Hamilton, Watertown, S. Dak., is President.

YOUNGSTOWN & SOUTHERN.—Announcement, it is reported, has been made by an officer of this company that this road will be extended from its present southern terminus at Columbiana, Ohio, to East Liverpool via Lisbon. Work is to be started by the company's men about the first of next month, simultaneously at East Liverpool, Lisbon and Columbiana. S. J. Dill, of Youngstown, will have charge of the work.

RAILROAD CORPORATION NEWS.

ATLANTIC & BIRMINGHAM.—It is reported that W. G. Raoul, President of this company, has bought the Wadley & Mt. Vernon, which runs from Wadley, Ga., south to Rockledge, 40 miles. The Wadley & Mt. Vernon has issued about $200,000 stock, and $750,000 bonds, although none of the bonds have been sold. An extension of the Wadley & Mt. Vernon from Rockledge southwest to Fitzgerald, on the Atlantic & Birmingham, 50 miles, would form a through line from Wadley to Thomasville, 180 miles.

BEECH CREEK COAL & COKE.—Kean, Van Cortlandt & Co., of New York, are offering at 98½ and interest a block of about $1,000,000 of this company's first mortgage 5 per cent. sinking fund gold bonds of 1944. These bonds are free of taxes in the state of Pennsylvania and an aggregate amount of not less than $75,000 at par per annum will be redeemed at par by lot by the operation of a sinking fund of three cents per ton on coal mined beginning June 1, 1907. They are guaranteed principal and interest by the Pennsylvania Coal & Coke Co. and are part of an authorized issue of $3,000,000, of which $2,572,000 is outstanding. They are secured by a first mortgage subject only to an existing mortgage debt of the Chest Creek Land & Improvement Company of $240,000, against which an equal amount of the present issue is reserved, upon approximately 28,000 acres of coal lands owned and 4,000 acres held under lease, in Cambria, Indiana and Clearfield Counties, Pennsylvania. The Beech Creek Coal & Coke Company shipped during its last fiscal year 1,676,194 gross tons of bituminous coal to markets reached via the New York Central & Hudson River. The company has a contract for 25 years from 1901 with the New York Central for the sale to that railroad of a minimum of 500,000 tons yearly. The gross earnings for the fiscal year 1904 were $2,299,954; operating expenses, $1,644,832, and net earnings, $655,122, less interest charges of $128,600, leaving a surplus of $526,522.

CANADIAN PACIFIC.—The land sales of this company in the Northwest Territories for 1904 amounted to 92,047 acres, from which $414,455 was realized. These figures are against 129,975 acres in 1903, realizing $535,329.

CHICAGO GREAT WESTERN.—A mortgage has been filed by the Mason City & Fort Dodge to the Central Trust Company, of New York, as trustee, to secure an issue of $12,000,000 50-year 4 per cent. gold bonds of 1955. This mortgage will be a first lien on the 378 miles of road owned, which is leased for 100 years to the Chicago Great Western with net earnings as rental and is part of the Chicago, Great Western's Omaha main line. The $1,380,000 old 6 per cent. bonds on the 92 miles from Mason City to Fort Dodge, owned in 1901, will be retired. After payment of the 4 per cent. interest on the new issue, any surplus is to be held in trust by the Chicago Great Western for the payment of future coupons. It is also agreed that the Mason City & Fort Dodge is to receive 60 per cent. of all the earnings from all business interchanged with the Chicago Great Western. Blair & Co. and Simon Borg & Co. have bought the $12,000,000 issue at a price said to be considerably above 80.

COLORADO & SOUTHERN.—Hallgarten & Co., of New York; the Berlinger Handels-Gesellschaft, the Bank fur Handel und Industrie, and the Swiss Bankverein have arranged to buy $17,000,000 4½ per cent. bonds of the Colorado & Southern. The proceeds from the sale of $8,000,000 of these bonds will be used for refunding purposes, and the remaining $9,000,000 will be used to build and acquire an extension of the Fort Worth & Denver City from Fort Worth, Texas, southeast to Galveston, 250 miles.

DELAWARE & HUDSON.—A meeting of the stockholders will be held on May 9, to authorize an increase of $5,000,000 in the capital stock. The $10,000,000 new 3½ per cent. bonds which have been authorized by the Albany & Susquehanna are to be convertible until April 1, 1916, into D. & H. stock on the basis of $500 stock for $1,000 of bonds. Thus the Delaware & Hudson will probably eventually come into possession of the entire issue of bonds. The bonds are to be issued to refund the $3,000,000 7 per cent., and $7,000,000 6 per cent. bonds of the Albany & Susquehanna, maturing April 1, 1906. They will be first mortgage 40-year gold bonds, bearing interest from April 6, 1906, and guaranteed principal and interest by the Delaware & Hudson. They will be offered to the stockholders pro rata at par.

At the same meeting the stockholders will vote on modifying the lease of the Chateaugay & Lake Placid as follows: "So as to provide that out of the rental to be paid by this company, as lessee, so much as is necessary for the purpose shall be applied to dividends on the new preferred stock of the lessor company issued to defray the expense of improvements on its railroad and payment of its mortgage debt."

ERIE.—Gross earnings for the month of February show a decrease of $285,719, working expenses (including one-twelfth of the year's taxes), a decrease of $178,208, and net earnings a decrease of $107,511, from $267,911 in 1904 to $160,400 in 1905. For the eight-months' period, gross earnings were $29,842,428 in 1905, against $29,801,903 in 1904; expenses, $21,789,342 in 1905, against $22,513,992 in 1904, and net earnings, $8,053,086 in 1905, against $7,287,910 in 1904, an increase of $765,176.

This company has increased its authorized limit of common stock from $113,000,000 to $133,000,000 to provide for possible conversion of the $10,000,000 4 per cent. convertible bonds issued in 1903. Holders of these bonds have the option of exchanging their holdings for twice the amount of common stock, which is now selling at about 45.

GRAND TRUNK.—The report of this company for the half-year ended Dec. 31, 1904, shows gross receipts of $15,210,896, against $15,252,954 for the corresponding half of 1903. Net traffic receipts were $4,494,154 in 1904 and $4,492,506 in 1903. There was an increase of $273,297 in passenger receipts and a decrease of $323,837 in receipts from freight and live stock. The Grand Trunk Western shows a net revenue debt after charges of $22,536 against a credit of $10,648 in 1903.

GRAND TRUNK PACIFIC.—The $15,600,600 first mortgage sterling bonds recently offered in London, England, by N. M. Rothschild & Sons, were guaranteed principal and interest by the Dominion Government, and were part of an amount of guaranteed first mortgage bonds to be issued to provide funds for building the Grand Trunk Pacific. These bonds are redeemable in 50 years from the date of issue. The Grand Trunk Pacific Company undertakes to pay all Canadian taxes now or hereafter imposed in respect to principal or interest. The bonds will be further secured by a first mortgage on "the railroad, undertaking, equipment and property, tolls, rights and franchises of the company, including all equipment and property to be thereafter acquired, but not including branch lines exceeding six miles in length, or the revenues therefrom, or the franchises in connection therewith, or such additional rolling stock as may with the assent of the government be designated and marked by the company as constituting equipment thereof, and not including ships or any municipal or provisional grants of land by way of bonus or subsidy to the company other than for railroad purposes."

INDIANA, ILLINOIS & IOWA.—The report of this company for the six months ending Dec. 31, shows gross earnings of $865,040 in 1904, against $775,415 in 1903; net income of $256,129 against $153,180 in 1903, and charges of $142,058 in 1904, against $137,242 in 1903. Dividends of 2 per cent. amounting to $100,000 were paid in both years, leaving in 1904 a surplus of $17,403 against a deficit in 1903 of $81,718.

KANSAS CITY SOUTHERN.—President S. R. Knott, in a letter to E. H. Harriman, chairman of the executive committee, has reviewed the record of the Kansas City, Pittsburg & Gulf and the Kansas City Suburban Belt Railroad since their reorganization in April, 1900, as the Kansas City Southern. He says that the reorganization expenditures were $1,681,133 in excess of the receipts from the reorganization plan, and the expenditures of the Kansas City Southern for betterments and additions were $2,181,844 in excess of the receipts from the sale of 3 per cent. bonds (these proceeds being the only receipts from reorganization, since no working capital was provided as arranged in the reorganization plan), making a total expenditure of $3,862,977 by the Kansas City Southern in excess of funds received and provided. The President states that the physical condition of the property at the time of reorganization was very poor, as much of the line had been hurriedly built and parts had been adapted from logging or lumber roads built for local purposes. In consequence, large expenditures had to be made for widening embankments and cuts, building bridges, yards, sidings, tracks, freight and passenger stations, section houses, water stations, and for additional shop equipment. The expenditures for maintenance of way improvement have reduced the cost of transportation, as is shown by a comparison of the annual report of the Kansas City, Pittsburg & Gulf for 1899, which shows that conducting transportation was 47 per cent. of the gross earnings, and the fourth annual report (year ending June 30, 1904) of the Kansas City Southern, which shows conducting transportation as 39 per cent. of the gross earnings, notwithstanding an increase since 1899 in the cost of labor, fuel and supplies. One statement in the letter has been thought to have a bearing on the announcement by a committee supposed to represent the Dutch interests in the road, that a new and independent management was desired. It is in substance, that the company would have subjected itself to danger had it taken a position of antagonism to the strong lines in its territory. The problem of the management has been to develop through traffic by exchange with connecting lines, and this could be done only by establishing and maintaining friendly relations with connections at all points where traffic can reasonably be interchanged. The fact that 73 per cent. of the freight traffic of the Kansas City Southern is business to and from connecting railroads, is the best argument in support of this policy. With all of the important connecting roads, however, while it interchanges important traffic of value both to itself and its connections, the Kansas City Southern actively, aggressively and honestly competes.

The total securities of the road now authorized and issued are: First mortgage 3 per cent. gold bonds of 1950, $30,000,000; preferred stock, $21,000,000; common stock, $30,000,000; a total of $81,000,000. These

securities apply on 839 lines of main line and branches, and in addition cover valuable terminal facilities at Kansas City. They also cover the ownership of the Port Arthur Canal and terminal properties at Port Arthur, Texas, all securities issued on which are deposited as collateral with the trustee of the Kansas City Southern Railway Company's 3 per cent. mortgage.

KETTLE VALLEY LINES.—The Republic & Kettle Valley and the Kettle River Valley, which run from Grand Forks, B. C., on the Canadian Pacific, south to Republic, Wash., 42 miles, together known as the Kettle Valley Lines, have changed their name to the Spokane & British Columbia. The capital stock has at the same time been increased from $1,000,000 to $5,000,000. The purpose of the increase is said to be to provide for an extension from Republic to Spokane.

LEHIGH VALLEY.—This company's statement for the month of February shows gross earnings of $1,952,719 against $1,990,896 in 1904; operating expenses of $1,443,645 in 1905, against $1,433,894 in 1904. This leaves net earnings of $509,074, and net income of $512,377 in 1905, and net earnings of $557,003 and net income of $568,025 in 1904.

MASSACHUSETTS ELECTRIC COMPANIES.—The Massachusetts Railroad Commission has given authority to the Georgetown, Rowley & Ipswich Street Railway Co. to increase its capital stock from $180,000 to $240,000 in order to purchase by exchange of stock at par the Haverhill, Georgetown & Danvers Street Railway. Both of these are subsidiary companies of the Massachusetts Electric Companies.

NEW YORK, ONTARIO & WESTERN.—For the month of February net earnings decreased from $63,922 in 1904 to $19,811 in 1905. For the eight months the operating ratio was 72.53 per cent. in 1905 against 78 per cent. in 1904; net earnings were $1,255,652 in 1905 against $958,328 in 1904, an increase of $297,324.

NORTHAMPTON & AMHERST (ELECTRIC).—The Railroad Commissioners of Massachusetts have approved the consolidation under this name of the Greenfield, Deerfield & Northampton, the Greenfield & Turner's Falls and the Northampton & Amherst Street Railway Companies, with a capital stock not to exceed $310,000. These companies together operate 47 miles of trolley road in western Massachusetts. Col. F. E. Pierce, of Greenfield, has been elected President of the consolidated company.

NORTHERN SECURITIES.—The opinion of the United States Supreme Court, written by Chief Justice Fuller, upholding the pro rata distribution of the company's assets, was filed on April 3. At the same time the decision of the court denying the motion, made by the Hill party on March 17, for the immediate issuance of the mandate to carry out the pro rata plan, was handed down. April 17 was fixed as the time when the mandate should issue and the case was remanded to the Circuit Court for the District of New Jersey, with directions to dismiss the bill applying for an injunction. The concluding statement of the opinion is as follows: "In fine, the title to these stocks having intentionally been passed, the former owners or part of them, cannot reclaim the specific shares and must be contented with their ratable proportion of the corporate assets." By the pro rata distribution, control of both Great Northern and Northern Pacific will be held by the Hill party.

PHILADELPHIA & READING.—The gross earnings for the month of February were $2,606,203, against $2,957,516 in January, and $2,574,171 in the month of February a year ago. Expenses were $1,622,489 against $1,652,657 in January, and $1,649,835 a year ago. This leaves net earnings of $979,754 in February, 1905, against $1,304,859 in January, 1905, and $924,336 in February, 1904. The net earnings of the Philadelphia & Reading Coal & Iron Co. increased from $191,779 in January, 1905, to $221,049 in February. This company's net earnings for February, 1904, were $374,795, and January, 1904, $291,317.

RAHWAY VALLEY.—The name of the New Orange Four Junction Railroad has been changed to the Rahway Valley, under which name a company was incorporated in New Jersey, with an authorized capital stock of $250,000 in July, 1904, to build a line from New Orange, N. J., the terminus of the New Orange Four Junction, to Summit, six miles. W. W. Cole, of Elmira, N. Y., is President.

RALEIGH & PAMLICO SOUND.—The block of bonds of this company, which was recently offered by C. Russell Sage & Co., of New York, were part of an issue of 30-year 5 per cent. bonds of 1934, limited in amount to $1,320,000. Of this amount, $30,000 are issuable as of date of Feb. 25, 1904. The authorized capital stock of the company is $900,000 common and $100,000 preferred. The Raleigh & Pamlico Sound is building a line from Raleigh, N. C., via Wilson and Greenville, east to Washington, 114 miles.

SOUTHERN INDIANA.—The Mercantile Trust Company and Francis Bro. & Co., of St. Louis, are offering at 95 and interest, $200,000 first mortgage gold 4 per cent. bonds of 1901 of this company, which operates a line from Westport, Ind., west to Terre Haute, 148 miles, and is building a line from Terre Haute north to Chicago, 133 miles.

SPOKANE & BRITISH COLUMBIA.—See Kettle Valley Lines.

SPRINGFIELD RAILWAY COMPANIES (NEW YORK, NEW HAVEN & HARTFORD).—This company is to be a holding company for the Springfield (Mass.) Street Railway, and will be organized with a board of directors, consisting of Chas. S. Mellen, D. Newton Barney, Frederick Harris, A. Willard Damon, James J. Storrow, William Skinner and Charles F. Brooker. It is to acquire the whole or a majority of the $1,958,400 capital stock of the Springfield Street Railway, and issue its own preferred stock in the proportion of $150 (one and one-half shares) for each share of the capital stock of the Springfield Street Railway Company. This preferred stock is a preferred claim up to 105 per share against all the property and earnings of the Springfield Railway Companies, and is entitled to semi-annual dividends of 2 per cent., the first payment to be made on July 1. The payment of dividends to the extent of 4 per cent. per annum, and in case of call or liquidation, the principal to the sum of 105 per share, of this stock, is guaranteed by the Consolidated Railway Company. On due notice, the trustees have a right to call and retire the entire issue of preferred stock at 105 and dividends on Jan. 1, 1906, or on any dividend date thereafter.

WABASH PITTSBURG TERMINAL.—This company, whose entire $10,000,000 capital stock (except sufficient shares to qualify directors) is owned by the Wabash, has recently listed on the New York Stock Exchange $25,000,000 first mortgage 4 per cent. bonds, part of an authorized issue limited to $50,000,000, and also its entire issue of $20,000,000 second mortgage 4 per cent. bonds of 1954, which are income bonds up to and including June 1, 1910. These second mortgage bonds are entitled to interest at the rate of 4 per cent. per annum, but up to June 1, 1910, such interest is payable "only out of the net earnings and revenues of the railroad company acquired during the periods to which said interest installments respectively relate." The action of the board of directors in determining the amount remaining as net earnings shall be final and conclusive as to the amount of interest, if any, so payable. No interest will be payable if the amount is less than one-half of one per cent., and up to and including June 1, 1910, interest shall not be cumulative. Both mortgages cover the company's entire line, which extends from a connection with the Wheeling & Lake Erie, near Jewett, Ohio, east to Pittsburg, about 60 miles; and all equipment, terminals, bridges, stations and contracts. They also cover $19,141,300 of the first preferred, second preferred and common stocks of the Wheeling & Lake Erie. The Wabash Pittsburg Terminal, since the execution of the mortgages, has acquired all of the capital stock of the Pittsburg Terminal R. R. & Coal Company, which owns practically all of the capital stock of the West Side Belt Railroad. The properties of these companies are subject to their own mortgages. The capital stock of the Pittsburg Terminal Railroad & Coal Co., owned by the Wabash Pittsburg Terminal, forms no part of the security of the W. P. T.'s first and second mortgages.

The Wabash Pittsburg Terminal has made three important contracts: (1) A contract with the Carnegie Steel Company, whereby the Carnegie Company agrees to give to the W. P. T., for transportation over its lines, one-fourth of all the traffic, including ore, coal and coke, controlled by the Carnegie Company or its allied companies (leaving out of the account freight of the Carnegie Company routed by water or over railroads controlled in any way by the Carnegie Company) consigned to or coming from points west of Buffalo and Pittsburg and west of the west line of Pennsylvania extended southward, which can be reasonably well served by the Wabash Pittsburg Terminal. (2) Contracts with the Wheeling & Lake Erie and Wabash, to continue for the terms of the first and second mortgage bonds providing for the interchange, so far as legally possible, of all traffic between the parties, fixing the division of earnings between the companies and making an arbitrary allowance in favor of the W. P. T. Under these contracts the Wabash and the W. & L. E. have running rights into Pittsburg, and the W. P. T. has running rights over those companies' lines. The Wabash and the W. & L. E. pledge 25 per cent. of their gross earnings derived east of Chicago and St. Louis from traffic interchanged with the W. P. T., to such an amount as may be necessary to meet any deficiency of income of the Terminal Company necessary to pay interest on its mortgage bonds. (3) A contract between the W. P. T. and the Pittsburg Coal Company providing for the operation by the latter company of the mines of the Pittsburg Terminal Railroad & Coal Co., upon terms which include the payment of a license tax by the Pittsburg Coal Company at $350,000 a year, being equal to the amount of the fixed charges on the entire authorized bonded debt of the Pittsburg Terminal Railroad & Coal Company, and a royalty of eight cents a ton on the coal mined under the agreement, which is to be applied to a sinking fund for the Pittsburg Terminal Railroad & Coal Company's bonds. The Pittsburg Coal Company also agrees to pay all taxes and insurance, and to ship over the lines of the Wabash Pittsburg Terminal and its connections a minimum amount of 4,000,000 tons of coal annually from its mines, this minimum to be increased proportionately as the total annual output of the Pittsburg Coal Company increases beyond 14,000,000 tons, which was about its production during 1904.

The balance sheet of Nov. 30, 1904, of the Wabash Pittsburg Terminal shows total assets of $56,215,424, including $40,182,220 charged to Cost of Road, etc.; $4,546,622 charged to Construction Expenditures, $6,000,000 charged to Wheeling & Lake Erie stock, and $3,159,740 to Pittsburg Railroad & Coal Company's stock. The Capital Stock amounts to $10,000,000; First Mortgage Bonds, $20,000,000; Temporary First Mortgage Bonds, $5,000,000, and Second Mortgage Bonds, $20,000,000.

WEST VIRGINIA CENTRAL & PITTSBURG.—This company is reported to have bought the Belington & Beaver Creek Railroad, which runs from Belington, W. Va., to Weaver, seven miles, and about 10,000 acres of coal lands belonging to the Weaver Coal & Coke Co. The company's coal has hitherto been shipped over the Baltimore & Ohio.